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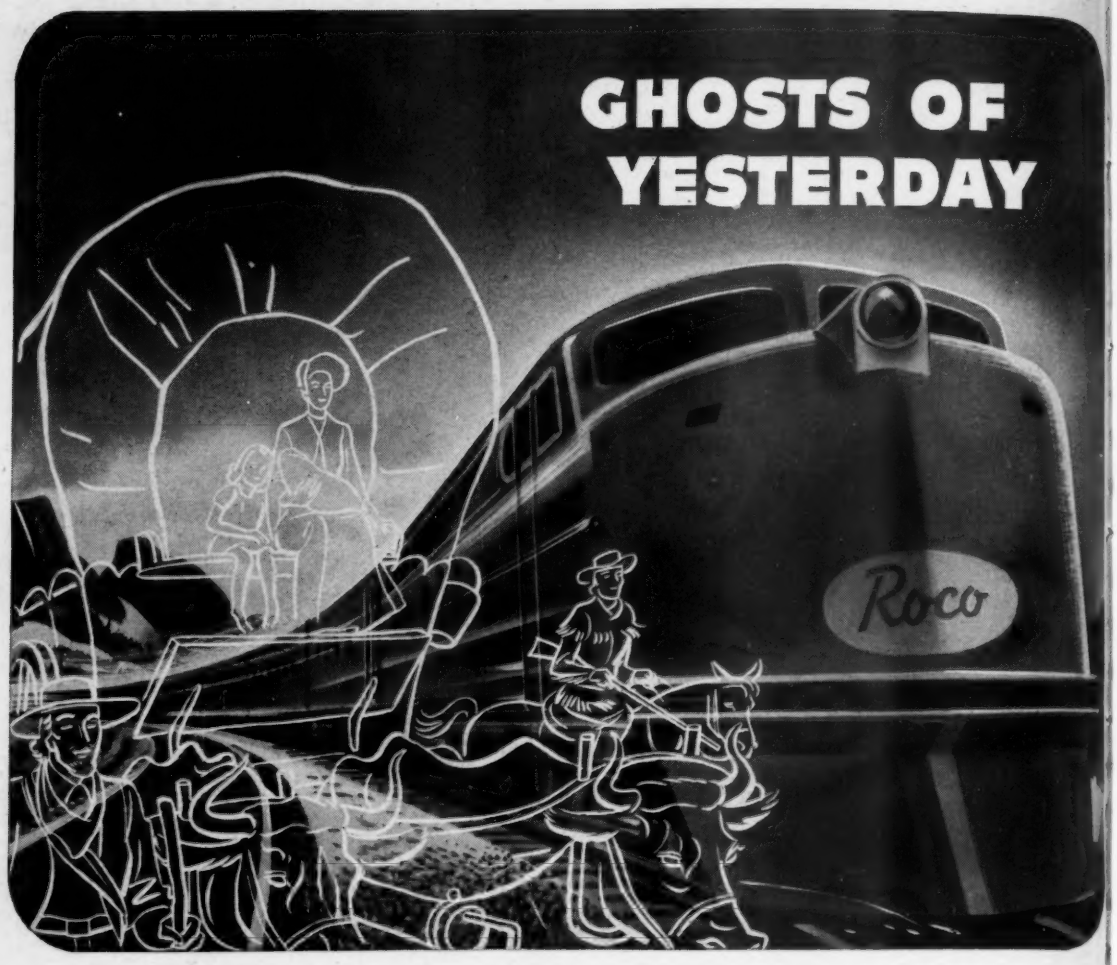

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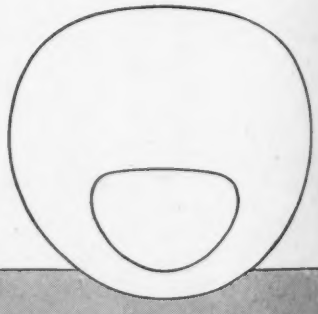

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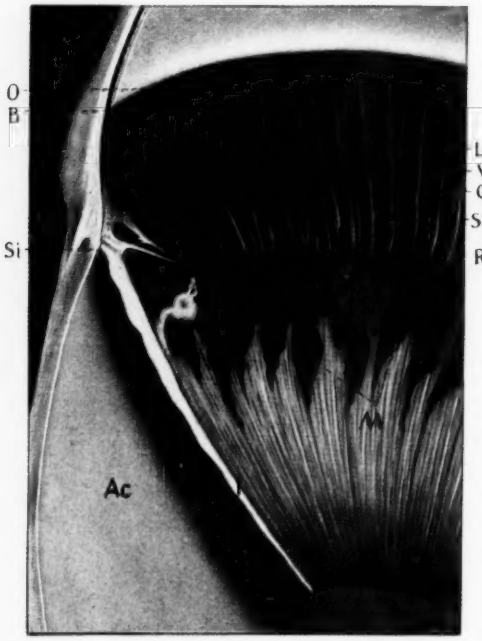

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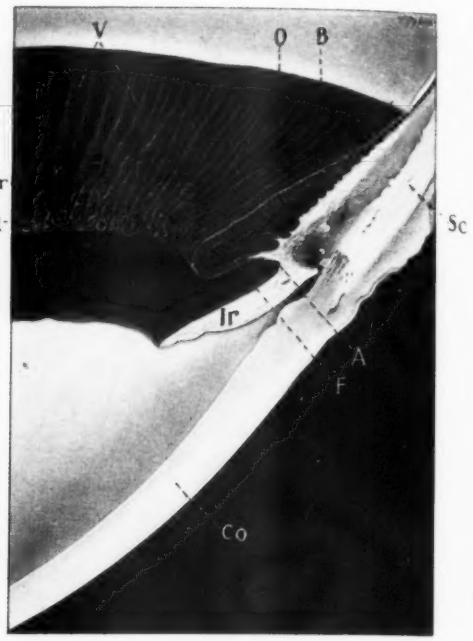
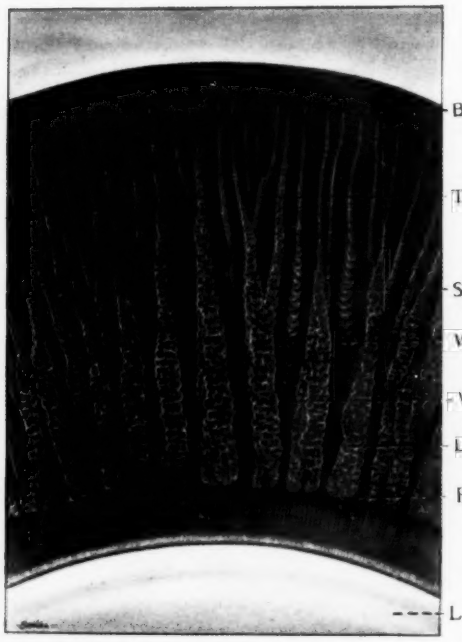


FIG. 7



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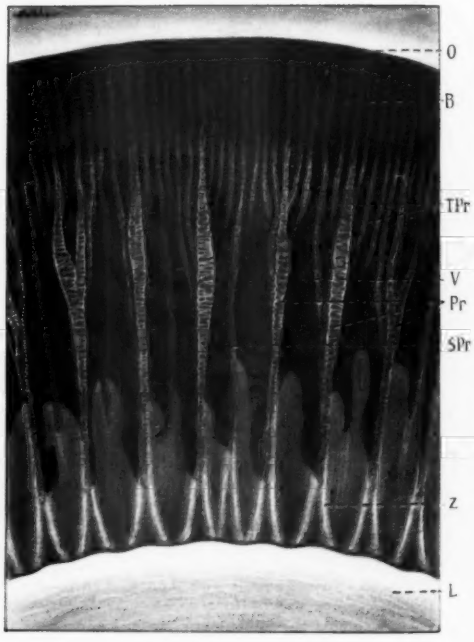

FIG. 8

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AMERICAN JOURNAL OF OPHTHALMOLOGY

VOLUME 25 JANUARY, 1942 NUMBER 1

MICROANATOMY OF THE EYE WITH THE SLITLAMP MICROSCOPE

II. COMPARATIVE ANATOMY OF THE CILIARY BODY, ZONULA AND RELATED STRUCTURES IN MAMMALIA*

MANUEL URIBE TRONCOSO, M.D.
New York

In a previous paper the structures of the angle of the anterior chamber in Mammalia were described, the data having been obtained by using a stereoscopic method of anatomic investigation with the slitlamp microscope.[20] The results obtained with this method were so interesting and opened up so many new viewpoints, that it has been deemed advisable to continue the study of the ciliary body and related structures in various kinds of mammals under the same conditions of observation.

The anatomical structure of the ciliary body and zonula has been thought to be very similar throughout the whole order of Mammalia. There are, however, very important differences, uncovered by the microanatomic method, which undoubtedly have significant bearing on the two principal functions of the ciliary body: 1st, the secretion of the intraocular fluid and, 2d, the accommodation of the lens for clear vision at varying distances.

TECHNIQUE OF THE EXAMINATION

The microanatomic method, in which the slitlamp microscope is used with high magnification (×30 and more, fig. 1) allows the observer to obtain frontal views of the structures in three dimensions and also lateral views of the same sections, thus correlating and determining their reciprocal relationships. The frontal aspects are particularly illuminating in as much as they give a clearer and more accurate idea of the complicated

*From the Department of Ophthalmology, Columbia University, and the Eye Institute, Presbyterian Hospital.

Fig. 4 (Troncoso). Posterior segment of the eye of a brown rabbit seen from behind. The lens has been detached. AC, anterior chamber; I, iris; M, membranous projections of the processes; SPr, secondary processes; LPr, principal or long processes; R, ridge of the ciliary body; Si, angle of the anterior chamber; V, valleys between the processes; B, smooth zone of the ciliary body; O, ora serrata.

Fig. 6 (Troncoso). The ciliary body of a pig's eye as seen from behind, formalin preparation. B, smooth zone; LPr, long or principal processes; L, lens; SPr, secondary processes; R, tuftlike ending of the heads; W, warts; V, valleys.

Fig. 7 (Troncoso). The ciliary body of a pig's eye seen from behind, formalin preparation. Co, cornea; Sc, sclera; Ir, iris; A, iridociliary angle between the iris and the ciliary body; F, ciliary front; R, ridge formed by the heads of the processes, Pr; V, valleys; B, smooth zone; O, ora serrata. The lens has been detached to show the whole ciliary body.

Fig. 8 (Troncoso). The ciliary body of a dog's eye seen from behind (formalin preparation, processes and lens shrunken). O, ora serrata; B, smooth zone or orbiculus; Pr, principal processes; SPr, secondary processes; TPr, tertiary processes; V, valleys; Z, zonular fibers very much stretched; L, lens.

architecture of the ciliary body than do the reconstructions obtained by the time-consuming interpretation of a considerable number of serial sections. Besides, in the microanatomical method, the specimens are neither altered nor distorted by long immersion in fixatives and dyes, but

amined from behind. (b) In the same section the cornea is completely excised beyond the limbus close to the scleral junction. The iris is seized with forceps and either excised with scissors, or torn away at the root all around the limbus. (c) In other well-hardened eyes a careful

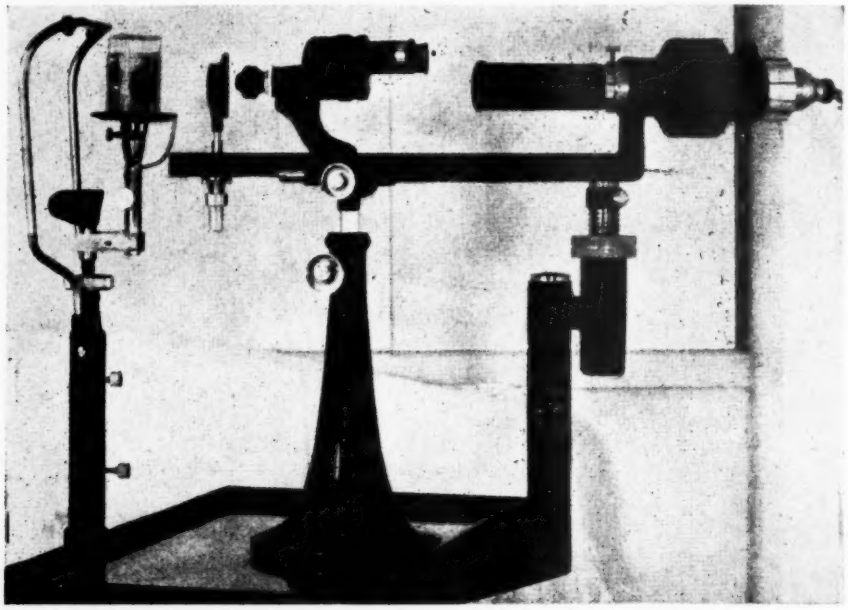

Fig. 1 (Troncoso). The specimen holder attached to the chin bar of the slitlamp microscope. A bisected sheep's eye is contained in the glass jar placed upon the revolving stage of the holder. (The microscope is not in focus.)

can be observed in natural colors soon after death or after a brief fixation period.

For the examination of the ciliary body the eyes should be examined either after fixation with formalin or in a fresh condition.

Formalin Specimens. The eyes are hardened in formalin (6 to 10 percent) for 1 or 2 days and then sectioned with sharp cataract knives or razor blades in the following manner: (a) The eyeball is cut transversely, 1 or 2 mm. in front of the equator, the vitreous carefully removed with forceps and blotter paper, and the anterior segment of the eye ex-

meridional section is made starting from the sclera, the iris is cleanly cut through on both sides, and then one lateral half of the eye is gently separated from the other half. Usually the zonula gives way easily on one side of the eye, while in the other half the lens stays in place. Both halves can then be easily observed laterally. The whole ciliary body, however, is more fully exposed if the lens is missing.

Specimens may be examined dry or immersed in a liquid. In the first case the section is mounted on the special stand described elsewhere[20] (fig. 2), while for a wet preparation the specimen is placed within a square glass jar containing a

preserving fluid (Kaiserling-Pick solution). The glass jar should have thin, very transparent walls.* The section is kept pressed against the wall by means of a piece of cotton or permanently with a strip of celluloid or cellophane conveniently shaped with scissors.

The dry specimens are more convenient for dissection with needle or forceps under the slitlamp, but they must be kept moist by fluid dropped from a pipette, otherwise they shrink and become distorted. Gross dissection may be made also under liquid by using an ordinary dissecting microscope; however, with this instrument the illumination is poor.

Fresh Specimens. In some cases, particularly those in which the architecture of certain anatomical structures is in dispute, it is necessary to examine entirely fresh sections. For this purpose the eye is enucleated immediately, or very shortly, after death and placed in saline solution. It is carefully divided with a cataract knife and with scissors, according to the kind of section required, as described before. The section is then placed in the glass jar filled with saline solution and gently pressed against the wall by means of a piece of cotton. The specimen may also be examined by the dry method, hanging by three threads from a perforated cork. This last technique, however, is not recommended, for the section dries quickly and curls at the edges even when kept moist. Fresh specimens should be examined immediately for even in the jar they quickly decompose. It is surprising how much the shape and arrangement of the structures in the fresh state vary from the appearance in the formalin-preserved eyes.

Zonula. For the demonstration of the zonula the same technique in sectioning the eyeball should be used. Formalin fixation provides very beautiful views of the fibers in Carnivora and Primates, both from behind and from in front of the sections, but in Ungulata and in rodents the zonula is difficult to see, since it is concealed by the processes. It is advisable to stain the zonula to obtain more accurate details and to make it possible to follow the course of the fibers. Beauvieux[23] recommended Mallory's method (methylene blue, orange G, and picrocarmin) and Egger[29] the chromium-acetic osmium method (Flemming solution) with only half the amount of osmium added. I have found Egger's method to be the best. The section should not remain in the solution

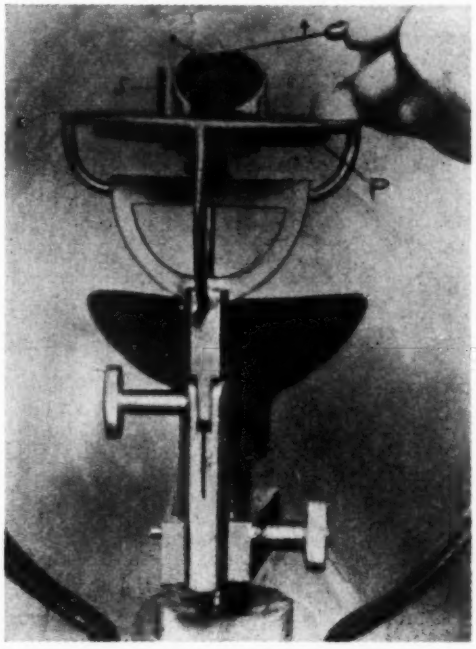

Fig. 2 (Troncoso). Details of the specimen holder for micro-anatomic investigation. The stage, P, is for dry specimens which are placed on the concave stand, S, and secured with thumbtacks or pins. The flat stage is substituted for P to accommodate the glass jar when the specimens are examined under water.

*I have used with advantage the so-called absorption jars made for spectroscopic work. The size for small eyes is 30 by 30 by 30 mm. Two or more specimens can be accommodated at the same time.

for more than one-half or one day. It is then washed with running water and examined either immediately, in a glass jar containing 20-percent glycerin solution, or hardened in ascending grades of alcohol and oil of turpentine for dry preparations and dissection. In order to obtain a clear view of the posterior zonular layer it is necessary after fixation to remove with fine forceps, under the microscope, the remaining vitreous and the hyaloid. With a fine hook the membrane is grasped over the lens and drawn off gently toward the ora serrata, where it is attached. The Flemming solution stains the zonular fibers yellow. It makes them also thicker and opaque. Another advantage is that the lens becomes soft and can easily be cut through, giving meridional sections, by means of which excellent side views of the arrangement of the structures can be obtained. Moreno recommends the use of Ziehl fuchsin for staining of the zonula, but I have found that the fibers do not stain—the color is only deposited over them.

By using a fine hooked glass rod, wire, or a fine forceps under the microscope, it is possible, in dry preparations, to raise from the processes the whole layer of the zonula and follow it to its insertion (fig. 16). Egger recommends for the human zonula the use of a mirror (Spiegelbezirk) with which, from the brilliance of the fibers and the increase of their reflecting power, it is easier to trace the course they follow until they reach the orbiculus ciliaris.

Inflation. The zonular spaces may be inflated by blowing air into them by means of a fine needle attached to a hypodermic syringe. The inflation is made in the back or in front of prepared sections, the needle being introduced carefully between the fibers in a direction parallel to the equator of the lens. In this way the so-called Petit space is easily demonstrated.

I. CILIARY BODY

A. Rodentia

RABBIT

When the anterior segment of the equatorially sectioned eye is observed from behind, in dark-coated animals, the ciliary body appears as a black girdle around the lens, which under the illumination of the slitlamp takes on a lighter-brown hue. This girdle is demarcated from the opaque retina by a clear-cut, almost straight line, *the ora serrata.*

Formalin Specimens. In white rabbits, there is little difference in color between the white, unpigmented, ciliary body and the opaque retina (fig. 3), the processes appearing to rise abruptly from the level of the fundus.

In dark-coated animals, the width of the pigmented ring in various meridians can be easily measured, especially under the microscope. The ring is not symmetrical but slightly narrower at the nasal side and above.

Under high magnification (×30) the brown girdle resolves itself into two parts: (1) a large number of prominent folds or ridges (LPr, fig. 4) which have a grossly radiated arrangement and resemble the lower aspect of a mushroom, *the corona ciliaris* (pars plicata); and (2) a smooth, flat zone, B, between the beginning of the folds and the ora serrata, the *orbiculus ciliaris* (pars plana). In the rabbit the smooth zone is so narrow that the processes start almost at the ora serrata. The processes begin as low, widely separated, meridional folds, LPr, which gradually become higher and thicker and take a triangular shape resembling thin, knifelike blades, with dull free edges. These blades converge like the spokes of a wheel until they reach the edge of the lens, where they disappear from view. In recently hardened specimens, the equator of the lens conceals the tip or head of the processes which are in contact with the

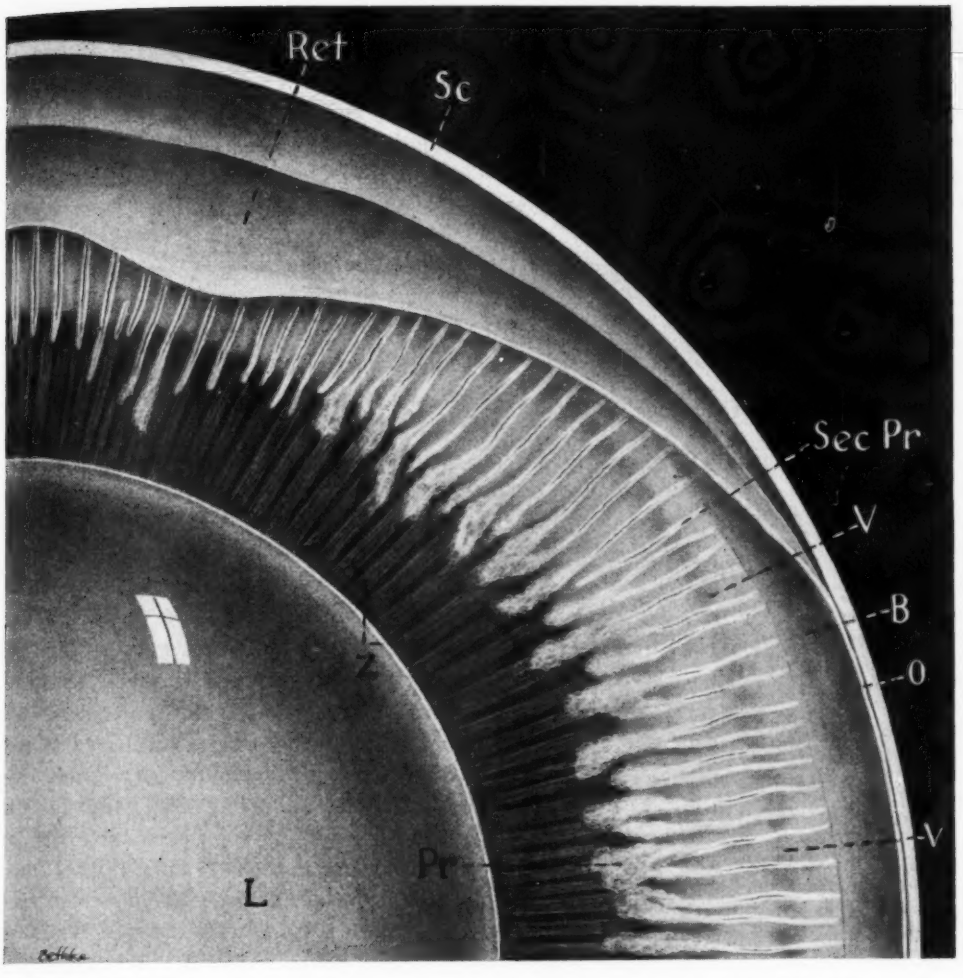

Fig. 3 (Troncoso). Rear view of anterior segment of the eye of a white rabbit. Old formalin preparation. Lens and processes are shrunk, zonular fibers stretched. Sc, sclera; Ret, retina; Sec Pr, secondary processes; B, orbiculus; O, ora serrata; Pr, principal processes; V, valleys; Z, zonula; L, lens.

anterior surface of the lens (fig. 20). However, by transillumination they can be seen indistinctly through the lens. In eyes kept long in the glycerin solution, the lens retracts and becomes separated from the heads of the processes, and the zonular fibers come prominently into view.*

When the ciliary body is studied in a half section of an eye from which the lens has been removed (fig. 4), the processes appear to end as rounded, thick, elevated heads that crowd together, forming a compact ridge, R. With indirect light, however, narrow superficial slits are to be detected between the heads.

* The usual description of the processes made from the observation of microscopic slides represents the corona ciliaris widely separated from the lens. This is an artifact due to the retraction both of lens and processes by fixatives and reagents.

There are two kinds of processes. The longer or principal, LPr, do not end at the ridge formed by the heads, but continue on the back of the iris by membranous prolongations, M, which will be considered later. The shorter or secondary processes, Spr, are thinner and lower than the others, and run along the floor of the deep, narrow valleys separating the longer processes. There are usually one or two secondary processes in each valley. The inner surface of the folds have a large number of raised, linear or rounded ledges resembling convolutions, C. At the valleys, V, these ledges are divided by perpendicular lines or cuts into small, elevated, round or sausagelike bodies. The convolutions are usually parallel to each other and become larger at the heads and in the membranous extensions of the folds. Undoubtedly, they correspond to capillaries, which, after running for some length, end in vertical tufts. There are about 108 processes in the corona of the rabbit.

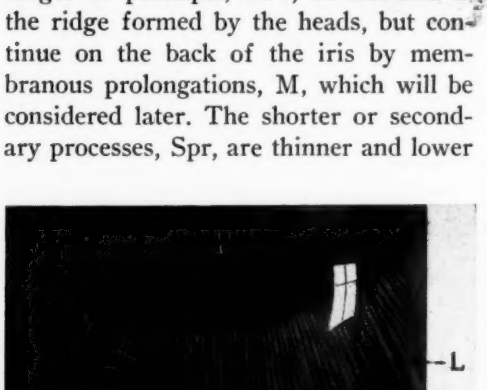

Fig. 5 (Troncoso). Eye of a dark-coated rabbit seen immediately after death. P, pupil; L, transparent lens through which the iris and heads of processes can be seen very well; EL, lens equator; Ir, posterior surface of the iris showing linear striations; M, membranous extensions of the processes crowded together in front of the lens edge forming a ridge; Pr, processes; Ob, orbicularis; Or, ora serrata; F, shallow furrow between processes and iris.

MEMBRANOUS EXTENSIONS: Looking at the corona ciliaris from the side in hardened specimens (fig. 4), the heads of the longer processes are seen to continue upon the posterior surface of the iris by membranous prolongations, M. These are not found in other adult Mammalia, although they have been described in the human embryo in pathological eyes and in the frog. These peculiar membranes, M, are triangular in shape, and their base is continuous with the head of the process, R, while the body tapers forward to a line that continues into the posterior surface of the iris, to the very edge of the pupil. They have been compared to fins or leaves. The membranes extend for about one half or three fourths the breadth of the iris. Their free edge or crest is erect, thicker, curved or folded, and covered with convolutions larger than those found on the sides of the folds. Thus, in the rabbit, the ciliary processes may be divided into two portions: the posterior—made of solid, bladelike folds—and the anterior or membranous, bound to the posterior iris surface. Usually, the short processes do not have extensions, but some may possess small, rounded ones.

Fresh Specimens. Because there were some doubts in my mind as to the way the membranous extensions are disposed in the posterior chamber, a fresh eye was examined, using the technique described before (see page 3). To my surprise, I found, upon looking through the transparent lens from behind (fig. 5), that all the membranous extensions instead of be-

ing erect were massed together in an almost solid wall in front of and around the anterior edge of the lens, EL. Few interstices were detected between the individual membranes, which in hardened, shrunken specimens are so widely separated from one another. This solid ridge, R (see fig. 4), entirely fills the upper recess of the posterior chamber and is separated from the iris by a shallow furrow, F. Beyond it, the posterior surface of the iris plainly shows its radiated striations. The overlapping of the lens equator by the ridge of heads is also easily verified in fresh specimens.

RELATION OF PROCESSES TO IRIS: When the ciliary body is examined laterally, in a meridional section, it is strikingly apparent that in the rabbit the thicker part of the corona ciliaris at the level of the heads (R, fig. 4) is located far forward in front of the root of the iris. If, through the angle of the anterior chamber at Si, we draw a line perpendicular to the iris, the membranous extensions, the heads, and more than half the length of the processes will be seen to be located in front of it, while the remaining part of the processes, including the orbiculus, will be in the ciliary body proper. For this reason the process in the rabbit should be considered as being embodied in the iris and forming a part of this structure. This is proved also by dissection. While in Primates and man it is easy to tear out the iris at the root without disturbing the processes, in the rabbit this maneuver is impossible. The iris always carries with it the extensions and parts of the processes themselves. In the rabbit the ciliary body proper is a continuation of the choroid, becoming thicker and running forward until it reaches the apex of the cilioscleral sinus. At this point it becomes attached to the sclera by a broad insertion that corresponds to the scleral spur in man. In my description of the angle of the anterior chamber, I called this posterior portion of the ciliary body the "attached portion" while Lauber and others call it the "scleral portion." The heads of the processes and the iris root are separated from the scleral wall by the cilioscleral sinus and are called the "detached" or "iridic" portion of the ciliary body.*

The ciliary muscle in the rabbit is rudimentary, and consist of a few longitudinal fibers which, starting near the choroid, run forward to the insertion of the ciliary body into the sclera. Some of the fibers continue forward, attaching themseves to the cribriform ligament or meshwork of the angle, which lines the outer wall of the sinus ending at Descemet's membrane.

The topography of the posterior chamber in the rabbit will be studied in a separate chapter.

VASCULAR SYSTEM: The vascular supply in the processes of rabbit has been studied by Baurman,[1] using injections of cinnabar gelatine. The arterial supply comes from the "circulus iridis major." Several arterial branches approach each process. The division into capillaries is extremely abrupt. In the membranous extensions the capillaries take the form of loops which have a very dense arrangement, collecting in great numbers within a small space, but allowing every individual capillary to have its wall exposed to the free surface of the process. As the membranous extensions are thin, the capillaries become exposed on both sides.

From the physiologic standpoint, the function of the membranous extensions is important. They greatly increase the

* For a complete description of these two portions of the ciliary body, the cilio-scleral sinus and the angle of the anterior chamber the reader is referred to the author's paper on comparative anatomy of the angle in Mammalia.[20, 21]

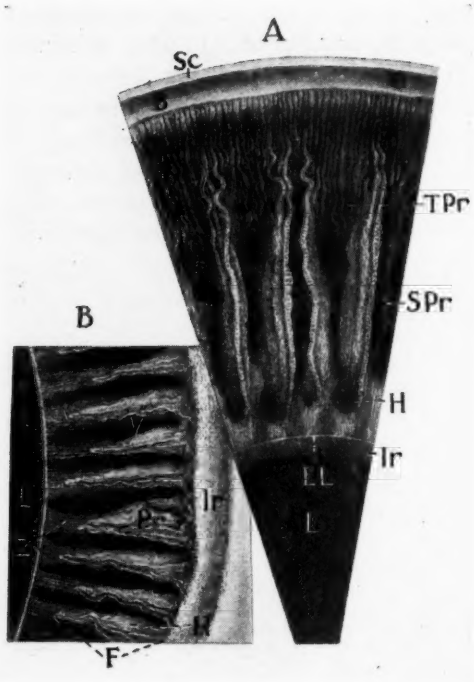

Fig. 9 (Troncoso). Ciliary body of a cat's eye: A, seen from behind, and, B, from in front. Fresh specimen, two hours after death. A: Sc, sclera; O, ora serrata; B, smooth zone; SPr, secondary processes; TPr, inner side of a principal process showing the thickness in the fresh state and the lateral ribs; H, round heads of the principal processes separated from the equator of the lens, EL, by the zonular fibers in the perilenticular space; Ir, pupillary border of the iris seen through the transparent lens, L.

B: The ciliary processes of the same eye seen from in front after separating the iris completely from the sclera. Ir, stump of the iris; Pr, base of the principal processes forming the ciliary front, F. The processes show great thickness in fresh condition. They are separated by deep valleys, V, which reach the periphery near the iris insertion; Z, zonula; L, lens; H, round heads of principal processes.

secretory surface of the processes, and the fluid they produce falls directly into the posterior chamber (see page 28).

B. Ungulata

PIG

The ciliary-body ring is asymmetrical, being narrower nasally and below and broader above and temporally. With the naked eye the flat zone appears wider, but with the microscope (×40) the proces-es can be followed almost to the ora, leaving a very narrow orbiculus ciliaris (fig. 6, B). The ora serrata is clear cut and slightly undulated. Viewed with the naked eye the ciliary-body ring appears jet black in color, but under the illumination of the slitlamp it takes on a light-brown color. In the narrower portion the ciliary processes (LPr, fig. 6) start close to the ora serrata as thin, low, separated folds, with serrated margins that anastomose with each other and gradually increase in thickness and height, converging until they reach the edge of the lens, where they almost touch each other. These folds are at the outset more numerous, closer, and thinner than in the rabbit, but farther on the heads become much thicker and broader, and the valleys between them shallower. There are in all about 100 processes all around the limbus of the pig's eye. The distinction between principal, LPr, and secondary folds, SPr, is also more apparent. The former have a clublike shape, and their heads end in tufts with separated, meridional, projections, R. Their broad flat surface has a markedly convoluted aspect, which could be grossly compared to a compressed pack of small intestines. The rounded convolutions are divided transversely by narrow white lines, which are also found at the sides of the ridges. There are usually one or two secondary folds, SPr, between the principal ones. In some instances their slopes have a crenated aspect, with deep pits between the ribs; in others, round elevations are formed, the so-called "warts," W. The secondary folds end at a distance from the heads or may even reach these at the bottom of the valleys, V. The clublike heads crowding together form a compact-looking ridge (R, fig. 7). At this ridge, the massed, rounded, individual processes

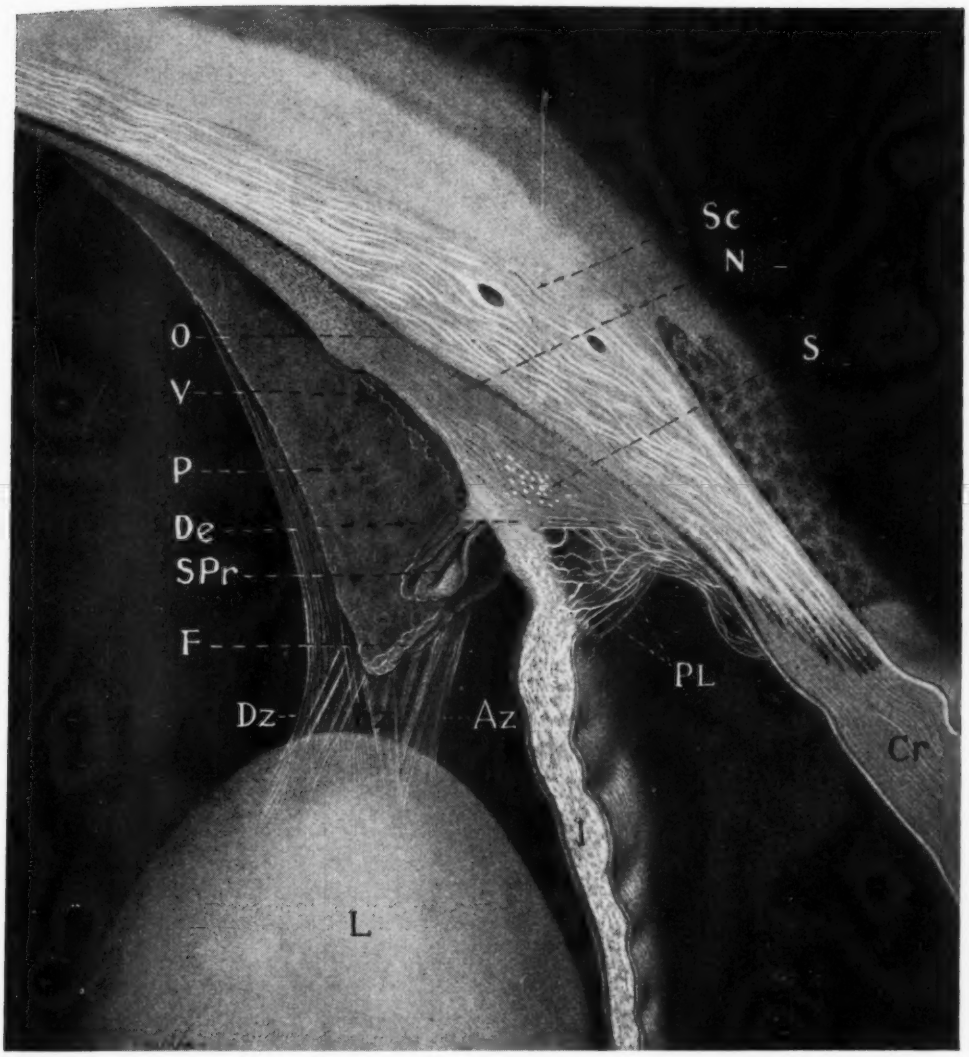

Fig. 10 (Troncoso). Meridional section of a lion's eye (formalin preparation). Cr, cornea; Sc, sclera; I, iris; PL, pectinate ligament. The first rows form the suspensory ligament of the iris; S. ciliosclerał sinus filled with the thin, fanlike pectinate-ligament fibers; O, end of the perichoroidal space; N, end of the attachment of the ciliary body to the sclera; O, attached portion, and De, detached or iridic portion of the ciliary body; P, lateral wall of a principal process, the section falling exactly into a valley, V; SPr, section of a secondary process near its end; F, bladelike head of the ciliary processes forming the ciliary front; Az, anterior layer of the zonula; Ez, equatorial fibers of the zonula criss-crossing with some of the posterior ones, Dz; L, lens.

merge together and running upward build a solid wall that ends at the iris root, Ir. Thus a deep iridociliary angle, A, is developed. This solid, compact wall is formed by the anterior surface of the processes from the ridge, R, to the angle, A, and may be called the *ciliary front,* F. In the meridional section (fig. 7) the processes take a distinctly triangular shape with a round apex, and anteriorly their

fused heads form the solid ridge, R. In fresh specimens, when seen from behind, the equator of the lens covers the tip of the processes (as in the rabbit) but after a time both retract and separate, so that the heads and the stretched zonular fibers show very clearly (fig. 6). These fibers appear uniformly to cover the front of the heads, rising from the lateral surfaces of the processes and running to the border of the lens. They will be described later.

Studied as a whole in a meridional section (fig. 7) the ciliary body shows the same features characteristic of the lower mammals. It is divided into two portions: the free and the attached or scleral. The latter has a triangular shape and extends from the choroid to the apex of the cilioscleral sinus.

CILIARY MUSCLE: The ciliary muscle is rudimentary, although better developed than in rabbits. It consists only of a bundle of longitudinal fibers running forward from the end of the choroid to the attachment on the sclera, at the apex of the sinus. Some fibers continue forward and merge with the cribriform ligament, which becomes inserted at the end of Descemet's membrane.

RELATION OF PROCESS TO ANGLE: In the pig, the greater part of the ciliary processes lies between the ora serrata, O, and the insertion of the iris near the sclerocorneal junction, Ir (fig. 7). Only about one third of their length extends inward from the iridociliary angle, A, to the ridge, R, which covers the equator of the lens. Thus in this animal, the ciliary body is structurally distinct from the iris. Its major portion lies behind the angle of the anterior chamber and its circulation is mainly ciliary.*

The posterior chamber will be considered later (see page 28).

SHEEP AND CATTLE

The ciliary-body ring of the sheep and of the cow is much more asymmetrical than it is in the pig. The eyes being larger, the processes are larger and the valleys a little deeper. The folds, primary and secondary, start with a great number of thin, rounded ridges like the roots of a tree, and then anastomose freely with each other (fig. 17). After a short course, the principal processes become rounded, broad, and higher, and take a clublike shape. The heads end in tufts, as in the pig. The crest and sides of all the folds have a markedly convoluted appearance. The characteristic features of the ciliary body are similar in the eyes of all the Ungulata. In as much as the eyes are so large in cattle, minute details, especially the structure of the zonula, are very clearly observable.

* For complete description of these two portions and the angle consult bibliography, references 20 and 21.

Fig. 11 (Troncoso). A. Ciliary body of a monkey's eye (Rhesus) seen from behind. Fresh specimen immediately after death, 15× magnification. Or, ora serrata; Ob, orbiculus ciliaris; Pr, ciliary processes; R, ridge of the heads of processes; EL, equator of the lens, which is perfectly transparent; Ir, iris seen through the lens; P, pupil. Pr, principal; SPr, secondary, and TPr, tertiary processes; Z, zonula.

Fig. 12 (Troncoso). The ciliary body of a human eye seen from behind. Formalin specimen. Or, ora serrata; G, pigmented zone parallel to ora; Ob, orbiculus ciliaris; W, warts or tertiary processes; Plic, plica ciliaris or secondary processes; Pr, primary processes; H, heads of processes.

Fig. 13 (Troncoso). Ciliary front in a human eye after removal of the iris, which has been torn up to its insertion into the ciliary body, C.B., at I. Pr, primary processes, T, tips of the heads; V, valleys; Z, zonula; L, lens. The processes have different lengths and thicknesses around the limbus according to the width of the ciliary body. Their shapes and sizes are slightly different from the normal due to shrinkage by the formalin fixation (compare with fig. 9, B).

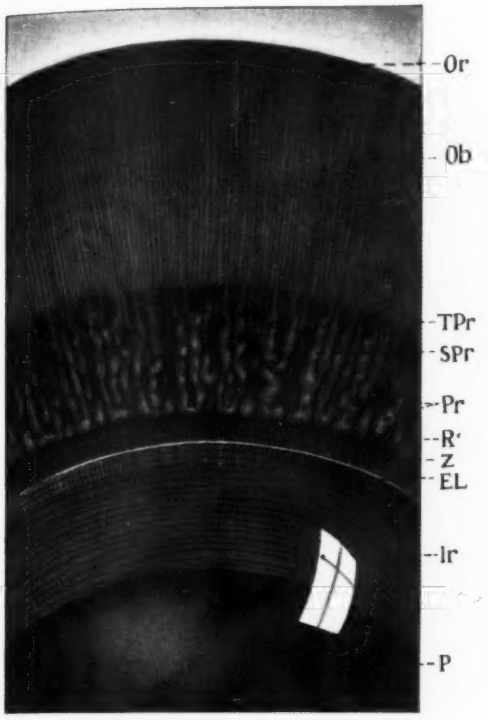

FIG. 11

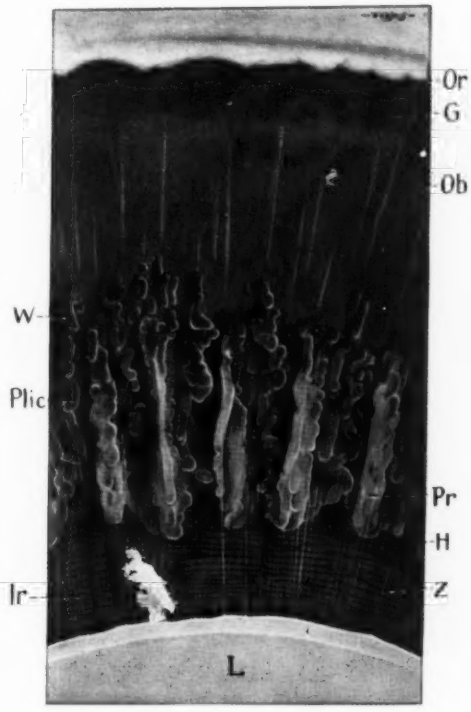

FIG. 12

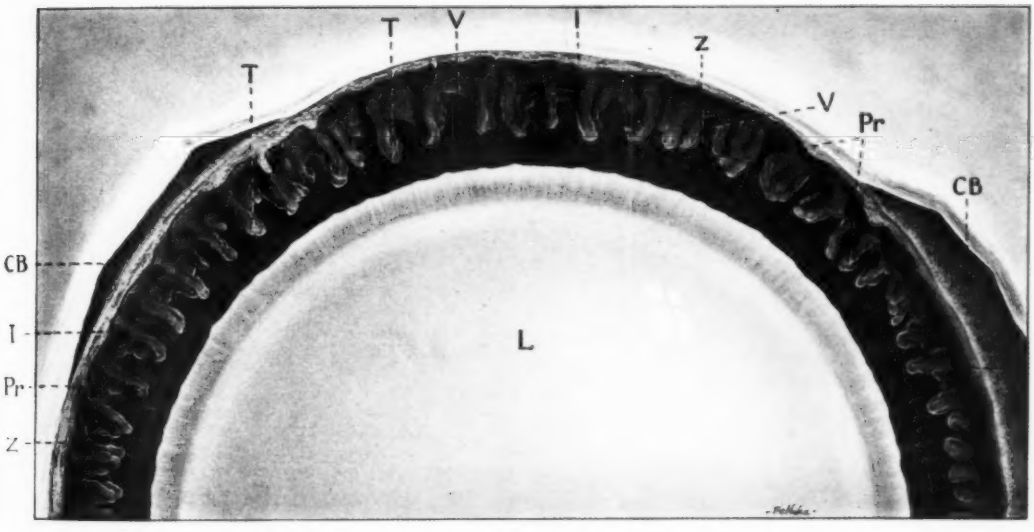

FIG. 13

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A Comparison between the Ciliary Body of Rodents and of the Ungulata

In both of these orders the heads of the processes touch the anterior surface of the lens immediately in front of the equator (figs. 20 and 21), but there is a great difference in the capacity of the posterior chamber. In rodents it is filled above by the membranous extensions. In fresh specimens these are crowded together and almost fill the roof of the posterior chamber proper. There is no ciliary front, properly speaking, but a mass of membranes separated from one another and from the lens capsule by narrow fissures, while in the Ungulata the heads of the processes are bound together in a compact wall at the roof of the chamber.

The shape of the processes is different. In the rabbit they are thin, bladelike folds, with deep valleys between, while in the Ungulata the processes are thick, clublike bodies with shallow valleys. The relation of the processes to the iris is also different. In the rabbit, half the length of the processes and the membranous extensions lie within the iris tissue, in front of the angle of the anterior chamber, making the corona practically a part of the iridic membrane. In the Ungulata, the processes lie between the root of the iris and the ora serrata. Thus in the latter the ciliary body is structurally different from the iris. From the physiologic standpoint, although in rabbits the anterior chamber is very large and deep, the small size of the folds is compensated by the addition of the secretory surface of the membranous extensions. In the Ungulata the long processes and the large ciliary front provide an abundant inflow of liquid.

C. Carnivora

Dog

The ciliary body is asymmetrical, being about 2½ mm. broader above and temporally. At the narrow parts of the ciliary ring there is almost no orbiculus ciliaris, but in all other places a wider, smooth band appears (B, fig. 8). The color of the ciliary ring is light brown, not so dark as in the Ungulata. The processes start at the orbiculus with numerous, low folds, almost touching one another. From these, at long intervals arise the principal processes, Pr, and between them the secondary, Spr, and tertiary, Tpr, folds. The principal processes arise from a thick root to which, a little farther on, many tertiary folds, Tpr, converge laterally, like the branches of a tree. The processes continue radially in long, straight, thin, bladelike ridges, Pr, which increase in height and become triangular with the base forward. Their tips or heads are rounded anteriorly. These folds are quite different from the processes of the Ungulata and more like the narrow, bladelike processes of the rodents. In fresh specimens the heads are separated from the equator of the lens by a short space, while in older specimens the shrinkage of the lens increases the distance more and more, leaving a large space in which the stretched zonular fibers, Z, show clearly. The principal processes have square-edged crests covered with convolutions which closely resemble a coiled wire. Their lateral surfaces are, however, quite smooth. By retroillumination they show a dense network of vessels.

The valleys, V, between the large folds are wide and very deep, much deeper than in the pig and rabbit. They contain the secondary and tertiary folds. While the latter, Tpr, are very short, the secondary folds, Spr, end in rounded tips a short distance posterior to the heads of the principal folds. The bottom of the valleys shows a marked corrugation which in some places rises into small, round protuberances or "warts." The heads of the processes do not merge to form a solid ciliary front as in the Ungulata, but are

separated from one another down to the floor of the valleys (fig. 9, B). The bottom of the valleys ends at about three fourths the length of the processes, so that the heads become free, and when seen from in front, after the iris is removed (fig. 9, B), appear as triangular blades separated like the teeth of a comb. All the valleys are in direct, wide communication with the posterior chamber.

In meridional sections the two portions of the ciliary body are clearly demarcated. As in the Ungulata, the attached portion starts from the choroid and thickens gradually until it reaches the attachment to the sclera at the apex of the sinus, Beyond it the detached portion forms the internal wall of the ciliioscleral sinus, and at its inner surface gives rise to the processes.* The iris is inserted by a narrow bridge and with the heads of the processes forms a wide irido-ciliary angle (see fig. 10, lion's eye).

The *ciliary muscle* in the dog, as in other Carnivora, is much more developed than in the Ungulata. It consists of two kinds of fibers: the longitudinal bundle is inserted posteriorly into the end of the choroid and orbiculus and anteriorly into the lateral insertion of the ciliary body into the sclera, at the apex of the sinus. Many of the fibers are continued forward by the cribriform ligament or meshwork tissue, which has been considered as the principal tendon of the muscle, although in reality it is only a secondary insertion, a check ligament.* The second kind of muscular fibers is a new set of fibers having an oblique direction. Some are in continuation with the inner, most longitudinal fibers, but the majority, starting from the detached portion of the ciliary body, run forward and outward to meet the inner ends of the fanlike pectinate fibers, which thus become the tendons of this oblique bundle.**

RELATION OF CILIARY BODY TO ANGLE: In the dog the ciliary body is entirely independent of the iris and throughout its whole breadth lies behind the root of this membrane and the sclerocorneal junction. In the section of the scleral wall the large cavities that contain the Hovius plexus are very apparent.

CAT

The ciliary body of the cat has the same features characteristic of the dog. However, in very fresh eyes, there are to be found certain differences in the structures (fig. 9, A). From the narrow orbiculus ciliaris the processes arise as very numerous folds so compact as almost to touch one another. The distinction between principal and tertiary folds is much more striking than in the dog. The former turn promptly into triangular blades that are considerably thicker than those seen in formalin-preserved specimens. The sides of the processes have straight meridional ribs that reach the heads. These, as in the dog, end in round tips widely separated from one another and rise abruptly from the bottom of the valleys. In the fresh eye, the distance between the heads and the equator of the lens (perilenticular space) is very short.

When the iris is removed the ciliary front appears from in front (fig. 9, B) not as a compact wall but as a comblike structure similar to that of the dog.

LION

I had the good fortune to obtain from the zoo the well-preserved eye of a lion. Due to its large size the observations were easily made and proved most interesting. The ora serrata is clear-cut and slightly undulated. The orbiculus is narrow. The processes have the same features characteristic of the dog and cat. Although much larger than in these animals, the processes are comparatively thinner, with narrow, bladelike crests. They have the

* See bibliography, reference 20.
** See bibliography, reference 21.

same triangular shape and rounded heads (fig. 10). The valleys are considerably wider and deeper than in the dog because of the size of the eye, and they communicate freely with the posterior chamber. Since the processes are so large and thin, by transillumination it is easy to see the network of capillaries. In a meridional section, especially when it passes through one valley (fig. 10), the side of the processes, their shape, and the difference between the attached and unattached portions of the ciliary body are very clearly established. The stout pectinate-ligament fibers, fixing the iris root to the sclera (suspensory ligament of the iris), and the finer, fanlike threads filling the cilioscleral sinus are beautifully clear. The zonular layers also show their course and connections very clearly.

RELATION OF PROCESSES TO ANGLE: As in the Ungulata, the ciliary body lies entirely behind the sclerocorneal margin. Opposite the corona ciliaris, the sclera shows large vascular cavities—the intrascleral or Hovius's plexus similar to that of the dog.

A Comparison between the Ciliary Body of Ungulata and of Carnivora

There are great differences in the position and arrangement of the structures in both orders of animals (figs. 6 and 9). In the first place, the processes in the Ungulata touch the lens equator, whereas in the Carnivora they are separated from the lens by a narrow fissure, the perilenticular space. This makes the anatomical configuration of the posterior chamber quite different in the two orders and changes the conditions of fluid outflow. (See pages 28 and 29). In the second place, the shape and connections of the processes are different. Whereas in the Ungulata the folds are thick, clublike bodies separated only by narrow, shallow valleys, in the Carnivora the processes are thin, bladelike folds, with wide deep valleys between. In the Ungulata, moreover, the heads of the processes form a solid wall on the posterior surface of the iris—the ciliary front —while in the Carnivora the heads are divided by deep valleys which give the ciliary front a comblike appearance, the interspaces allowing a free, direct communication between the posterior and anterior chambers. It is highly probable that the solid ciliary front of the Ungulata provides for a larger amount of secretion than the comblike front of Carnivora.

D. Primates

RHESUS AND CHIMPANZEE

In looking at a posterior view of the anterior segment of the eye in monkeys the observer is struck with the great breadth of the orbiculus ciliaris in relation to the size of the processes (fig. 11). The flat zone is almost twice the length of the processes or two thirds the width of the ciliary body. It is of a light, grayish-brown color, while the processes are darker brown. The ora serrata is almost straight cut, and lacks the large undulations characteristic of man. In front of it is a wide, slightly pigmented band. The surface of the orbiculus is crossed by numerous meridional, slightly raised striae which run forward into the valleys and into the roots of the folds. The processes are very small in comparison with those of the Ungulata and the Carnivora and quite different in appearance. They have a darker-brown coloration than has the flat zone. Beginning as pointed, low, square, ridges the processes soon divide into principal, Pr, secondary, SPr, and tertiary folds, TPr (fig. 11). The last named end after a short distance, while the secondary continue to the base of the principal folds. These are widely separated from one another. They rise abruptly and thicken almost immediately, form-

ing curved, wavy blades whose crests remain straight or bend back upon themselves for a short distance. They end in round, semicircular or clublike heads, Pr, which converge toward the edge of the lens, from which, in fresh specimens, they are separated by a short space. The heads remain independent of one another throughout the extent of their elevation so that from the anterior view they resemble the posts of a fence, as in the Carnivora. The surface of the processes is smooth and does not have the convoluted aspect so characteristic of the Ungulata. However, the secondary processes may have this appearance and even, in the depth of the valleys, form numerous "warts." The valleys between the processes are deep and in direct communciation with the posterior chamber. In a meridional section (fig. 20) the shape of the corona ciliaris is quite different from that of the other mammals. The processes, Pr, are short in length, arise abruptly from the orbiculus, Ob, and then assume a cockscomb shape (fig. 25), with an irregularly undulated border inward, while outward their anterior part (ciliary front, F) is made by straight-cut, separate blades (fig. 20). The iridociliary angle is rounded and deeper than in the Ungulata, reaching to the level of the sinus trabeculum. The corona ciliaris comes to lie directly above the equator of the lens. In fresh eyes the distance between these structures is small, but in preserved eyes increases progressively with the shrinking of the lens and processes. The zonular fibers, difficult to see in fresh specimens, become more apparent in old hardened eyes.

THE CILIARY MUSCLE: The development of accommodation brings a great change in the ciliary muscle of monkeys. In a meridional section the course of the fibers can easily be studied on account of the great amount of pigment granules between the bundles. The longitudinal fibers are slightly more developed than in the Carnivora, but the oblique or radial bundles are much more apparent (fig. 20). They now fill the spaces formerly occupied by the pectinate ligament, which in the monkey is rudimentary. The muscular fibers radiate from the scleral spur and some from the anterior surface of the ciliary body and run to the base of the processes. The circular fibers are not visible.

RELATION OF THE PROCESSES TO THE ANGLE: The ciliary processes are located in front of the angle of the chamber and the sclerocorneal junction. As in the Carnivora, the root of the iris is entirely separated from the processes and directly inserted into the anterior border of the ciliary body and the greatly developed ciliary muscle.

E. MAN

The ciliary body has the shape of a girdle, narrower on the nasal side and above, wider on the temporal side and below. Having less pigment than in the monkey and the Ungulata, the color of the girdle in man is much lighter, both at the corona and at the orbiculus. In adults the crest of the process or free border turned to the vitreous is less pigmented than are the sides of the valleys (fig. 12). The color, however, changes with age. As reported by Hess, the processes in the fetus have a dark-brown color, while in old age they lose their pigment and become almost white. The orbiculus also becomes discolored with age, but to a lesser degree than do the processes.

As in the monkey, what strikes the observer first is the comparatively small size of the processes in relation to the flat zone, the width of which is about twice the length of the processes. The surface of the orbiculus is smooth, except for

radial, slightly raised striations which are of a lighter hue. Some of them are thicker and are in continuation posteriorly with the depressions between the teeth of the ora serrata. Anteriorly, the striae end in the valleys between the folds and in the roots of the latter.

Parallel to the ora serrata and following its large undulations there is usually a narrow, darker girdle (fig. 12, G), whose pigmented surface does not show such conspicuous striations as does the rest of the orbiculus. There is a great difference between the anatomic architecture of the corona ciliaris in monkey (Rhesus) and man. While in the former the principal processes are closer to each other and the secondary and tertiary folds are of a similar structure, in man the principal processes, Pr, become of paramount importance. The secondary folds are reduced to numerous small, sausagelike bodies, called "plicae ciliaris," or to round, raised elevations known as "warts." These course along the floor of the valleys between the principal folds and come to an end near the heads. Under the slitlamp illumination they are brown in color with white borders, similar to the pigmentation of the floor of the valleys. The principal processes are widely separated from one another. They start almost abruptly between the warts (fig. 12), rise, and thicken rapidly, forming bladelike, triangular folds whose white crests are broad and almost straight until they reach the heads. These end in round tips which form a circular ridge directly above the equator and are separated from the lens by a wide space (the perilenticular space, fig. 21). In it the zonular fibers are easily observable, especially in old specimens. The sides of the processes instead of being smooth as in the monkey, have a markedly convoluted aspect. Between them deep valleys are formed along whose floor run the plicae ciliaris or secondary folds. Seen from in front after the removal of the cornea and iris, the bases of the heads of the processes (ciliary front) have a comblike arrangement, the light blades being separated by deep grooves whose bases reach peripherally almost to the iridociliary angle (fig. 13). Where there is a natural or artificial iris coloboma in living eyes, the ciliary front is easily seen with the gonioscope. The processes in a normal eye have the same appearance as in figure 13, although they are thicker and not so widely separated as they appear to be in the specimen, for there the action of formalin has shrunken them in all dimensions. Pathological changes in the processes are also seen with the gonioscope when an operation uncovers the ciliary front. The valleys between them communicate freely with the posterior chamber. In a meridional section passing exactly through one of the valleys (fig. 26) the principal processes do not show the classical triangular shape. They appear more like irregularly elliptical folds similar to a cockscomb and rise abruptly upon a thick base which contains the fibers of the ciliary muscle. Under great magnification the course of the longitudinal and oblique radial fibers of the ciliary muscle is easily followed, but the circular ring is not apparent. The ciliary body is inserted laterally into the sclera by a narrow fibrous ring, the scleral spur (fig. 14), which separates the anterior chamber from the perichoroidal space and is in relation forward with the base of the sclerocorneal trabeculum. The superficial part of this meshwork merges with the anterior side of the ciliary body, forming the sinus of the chamber, while the rudimentary pectinate ligament fibers (the so-called iris processes or uveal trabeculum), run from the last roll of the iris downward, bridge the sinus, and course forward over the corneal trabeculum until they reach its end at Schwal-

be's ring. The pectinate fibers are sparsely distributed with large spaces between them.

VASCULAR SYSTEM: The distribution of vessels in the ciliary body of man is perfectly adapted to the production of the intraocular fluid. Whereas the processes are very rich in vessels and capillaries, the orbiculus has a small number of branches running mostly in a meridional direction (fig. 15). Every process usually has its own arteriole, or several arterioles may run into the same process. The transition between arteriole and capillary is abrupt. The capillaries anastomose freely with one another and crowding together form the body of the corona ciliaris. Although they appear to be massed in a small space, every capillary has a portion of its length in contact with the free surface of the process. According to Baurman[1] the total surface of the capillaries is about 6.7 cm. Nicati considers this value to be only 6 cm. By this means the vessel surface will comprise 112 percent of the total surface of the processes. The veins often run along the crests of the folds, then cross the orbiculus, and collect at the internal side of the muscle at the vortex veins.

A Comparison between the Ciliary Body of the Primates and of the Carnivora

The most important difference is the small size of the processes and the very wide orbiculus in primates (fig. 12) in contrast to the long processes and narrow orbiculus of the Carnivora (fig. 9). In the latter the principal processes have the appearance of triangular blades with their apices near the ora serrata, while in the Primates the processes are at a distance from the ora serrata and become so short that they occupy only one third the width of the ciliary body, the orbiculus containing the other two thirds. In the Carnivora the secondary processes are well developed and sometimes extend almost to the heads of the principal processes, while in the Primates the secondary folds are reduced to small, sausagelike ridges or small round "warts." In man the principal processes are more developed in width and their crests are broader. In a section these have a rounded, earlike shape and are covered with convolutions.

These anatomical differences probably have some relation to the quantity and perhaps even to the quality of the aqueous humor produced. A large amount of aqueous is required to fill the large deep, anterior chamber of the Carnivora; while the small, shallow, anterior chamber of the Primates needs comparatively less fluid. For this reason the processes are larger and closer in the Carnivora, shorter and more widely separated in the Primates. The orbiculus has probably little or no secretory function. The disposition of the capillaries is probably different. The crests of the folds in man are almost without pigment. Histologic examinations have shown that the cuticular layer is missing in the ciliary front of the human processes, thus allowing the fluid from the capillaries to penetrate more directly to the cubical cells of the ciliary epithelium at the ciliary front. The extrazonular portion of the processes probably includes the greater surface of the secreting membranes (see page 25).

II. THE ZONULA

An immense amount of research has been done and a voluminous literature has accumulated in regard to the anatomy and histology of the zonula, particularly in man. With a few exceptions, it has been worked out by the examination of microscopic slides—that is, from the side—the frontal aspects and the relations of the structures being reconstructed by serial sections.

It is not necessary at this time to review the opinions of the authors from Zinn to the modern researchers who have dealt with the subject. A brief list of the principal articles will be found in the bibliography.

Beauvieux[23] (1922) was the first to examine anatomically, with the slitlamp microscope, the human zonula in fresh eyes of cadavers. He describes it as a continuous membrane on which run the zonular fibers, bound together by an interfibrillar or transparent substance. Thus he reverted to the theory of former anatomists, who also considered the zonula to be a membrane. Loddoni[32] (1929) used the slitlamp for the examination of fetus eyes aged from three months to adult life. He saw that the zonula consisted of fine membranes composed of fibers and a transparent cement substance. Egger[29] (1924), using the same apparatus, described the zonula in man as a series of fibers whose course he could easily follow in stained preparations. Moreno[36] (1933), like Beauvieux, considers the zonula to be a membrane made up of fibers bound together by a cement substance. Teulieres and Beauvieux[42] (1931) occasionally used the slitlamp in examining eyes of vertebrates; but their report is based mainly on microscopic sections. Duke-Elder[28] is also convinced of the membranous character of the human zonula in its anterior and posterior layers.

Biomicroscopic examination of the zonula in living eyes through a natural or artificial coloboma clearly showed the arrangement of the fibers, but no mention has been made of the existence of a membrane. The conclusions of the modern investigators have not yet been fully accepted, and there are still many unsettled questions about the structure of the zonula, its anatomical characteristics, and its relation and insertion into the processes.

Using the slitlamp microscope, I have tried to elucidate these problems by a comparative study of the zonula in mammals. The large size of the eyes of the Ungulata and Carnivora makes them especially suitable for this investigation. The eyes may be examined fresh or after fixation in formalin. The best way to detect the zonular fibers is to use Flemming's solution, which stains them yellow and makes them opaque and shining (Egger).

The question as to whether or not the zonula is a continuous membrane can be decided by making dissections under the slitlamp microscope. Numerous examinations of fresh, fixed, and stained eyes have convinced me that the zonula is composed of membranes upon which run numerous thin fibers bound together by a transparent, interfibrillar substance. Under the action of fixatives and dyes this interfibrillar substance usually disappears, while the fibers become more apparent as they are stretched tight by the shrinking of lens and processes.

The general anatomical arrangement of the zonula is about the same in all mammals. There are, however, differences in the thickness and size of the fibers, their insertions, and their relationship to the processes which it is important to describe minutely, for they significantly affect the physiologic functions.

A. Rodentia

RABBIT

In eyes examined immediately after death, the zonula is difficult to see from behind, for the equator of the lens covers the heads of the processes and the membranous extensions (see page 6 and figs. 5 and 22), so that the zonular fibers appear faintly over and between the processes. In formalin specimens, in which the lens has shrunk and become separated from the processes, the zonular fibers show very clearly (fig. 3). To this artifact

corresponds the classical description of the zonula, which appears to be divided into numerous bundles, running from each side of the heads of the processes to the equator of the lens. In sections stained with Flemming's solution, and especially as observed by indirect illumination, the brilliant, opaque fibers can be followed into the valleys where they become inserted into the sides of the processes, while others run to the apices. They seem to end there, between the apices, no trace of them being detected over the narrow orbiculus ciliaris. If, from a fresh eye, the cornea and then the iris and heads of the processes are removed, the zonula can be easily observed from in front. Although very delicate, it can be cut transversely, under the slitlamp microscope, with fine, pointed scissors (not with a knife, which only slides as the surface yields). The lips of the rent separate at the edge of the section. Between the cut tips of the fibers, binding them together, the interfibrillar cement substance is discernible.

In a lateral view (fig. 22) the zonula appears as a small triangle over the equator, divided into an anterior and a posterior layer, with numerous massed fibers between. The two layers meet at the apex of the triangle (at i), and then continue together, dipping into the valleys at the union of the first with the posterior two thirds of the processes.

The zonula, however, does not line the whole extent of the surface of the processes. There is a portion (fig. 22, Ex) which remains outside the anterior layer and includes the head and membranous extensions. This may be aptly called the *extrazonular* portion of the processes, while the part lined by the zonula, including the posterior part of the folds and the valleys, may be designated the *intrazonular* portion. This division has a physiologic importance, as will be mentioned in the chapter devoted to the anatomy of the posterior chamber.

B. Ungulata

CATTLE

Because the eyes of cattle are very large, the study of the zonula is much easier than it is in the rabbit. Here also the relationship of the processes and lens is different in the fresh from that in formalin-fixed eyes. In the former (see page 9) the heads of the processes forming the solid ciliary front are in contact with the anterior surface of the lens just in front of the equator (fig. 23). The zonula is difficult to see from behind and is entirely concealed in front. To determine its structure it is better to observe it first from in front after the iris has been forcibly torn from its root, a removal which also carries with it the heads of the processes. The zonula then appears (fig. 16, A) as a semitransparent membrane on which a faint fibrillation can be detected. This is more marked when seen by indirect illumination. If the section is placed in the dry stand and the zonula divided transversely with fine scissors, under the microscope, the unmistakably membranous structure is evident (fig. 16, B). The cut edges show a continuous, unbroken line, the fibers being bound together by a fine, semitransparent cement. Working in front, the vitreous is not touched unless the posterior zonular layer, Pz, is also divided by the scissors. In figure 16, B, there appear to be two membranes separated by an empty space. In reality this space is filled with numerous transparent fibers. In formalin preparations the fibers become more and more distinct with age, as they are stretched between the lens and processes by shrinking.

Following the zonula to the heads of the processes, these appear to be buried in depressions or grooves (fig. 17, G), produced by the undulations of the anterior zonular membrane where it hugs the crests of the folds. Between the heads, H, H, on the other hand, convex eleva-

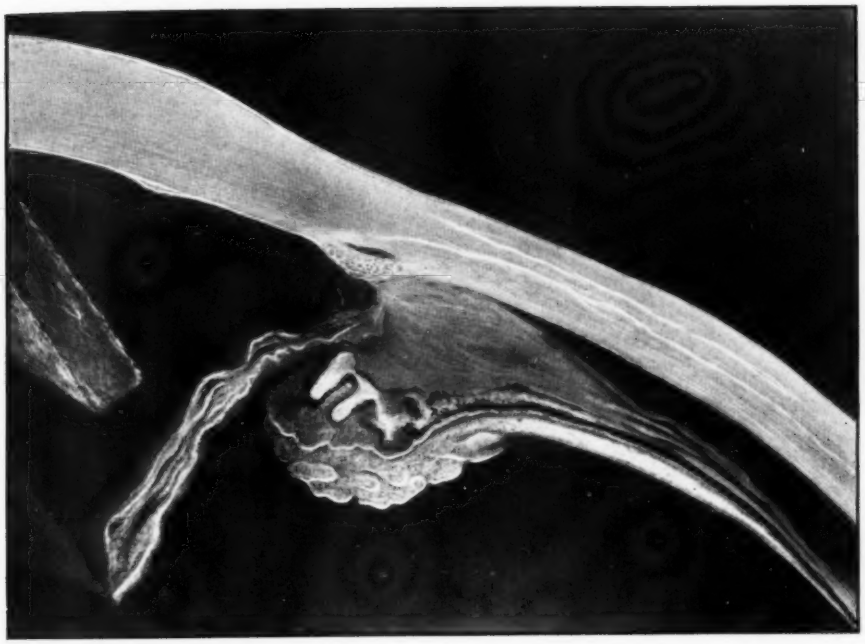

FIG. 14 (TRONCOSO). MERIDIONAL SECTION OF A MAN'S EYE (X30). THE IRIS IS PUSHED DOWN BY A PIECE OF CARDBOARD WHICH STRETCHES THE FIBERS OF THE PECTINATE LIGAMENT, BRIDGING THE RECESS OF THE ANGLE OF THE ANTERIOR CHAMBER. SCHLEMM'S CANAL APPEARS AS A NARROW SLIT DIRECTLY ABOVE THE INSERTION OF THE CILIARY BODY AT THE SCLERAL SPUR. AT THE INNER SIDE OF SCHLEMM'S CANAL THE TRABECULUM STANDS OUT AS A CONVEX, SPONGY MESHWORK SEPARATING THE LUMEN FROM THE ANTERIOR CHAMBER (SEE ALSO FIG. 26). (THIS FIGURE WAS PUBLISHED AS FIG. 28 IN THE FIRST ARTICLE OF 'MICROANATOMY OF THE EYE WITH THE SLITLAMP MICROSCOPE."[20])

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tions of the membrane, F, correspond to the valleys.

The zonula, however, is not attached to the heads of the processes, but runs back and becomes inserted into the junction of the anterior third and the posterior two thirds of the processes, leaving the heads free (fig. 23, i).

The course of the fibers in the posterior zonular layer from the lens to the orbiculus may be seen better in stained sections, especially when Flemming's solution is used, as described by Egger. From the equator of the lens the posterior zonular layer is seen running tentlike to the level of the processes (fig. 18, A) until it reaches the anterior layer at about the junction of the anterior third with the posterior two thirds of the length of the processes (fig. 23, i). There the two layers merge, but they course together over the crests and dip into the valleys as a continuous membrane. In chromium-acetic-osmium-dyed specimens the yellowish fibers are seen reaching the floor of the valleys and spreading on each side over the slopes of the folds to which they become attached. The fibers run back into the sides of the valleys until they end at the apices of the processes. They do not reach the narrow orbiculus of cattle. The long extent of fibers firmly attached to the sides of the processes is a necessary anchorage to keep the fibers constantly tight when there is no accommodation and to relax them in case the latter function is exercised. In addition to the membrane

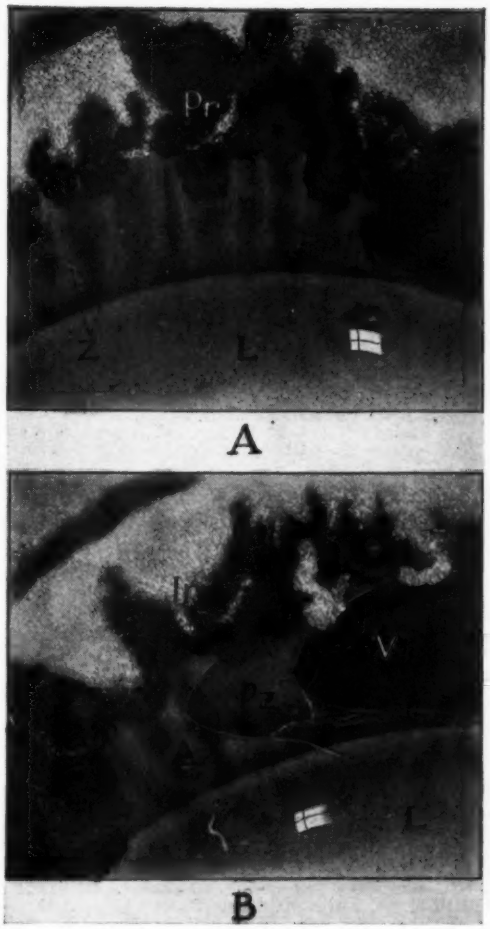

Fig. 16 (Troncoso). Zonula in a fresh eye of cattle. A: Seen from in front, after cornea and iris have been removed. Stumps of the processes, Pr, remain adherent to the ciliary body; L, lens; Z, zonula.

B: The same eye after the zonula was cut transversely with pointed scissors. The anterior, Az, and posterior, Pz, zonular layers appear as thin membranes separated by a space which looks empty, but in reality is filled with numerous transparent fibers. The black background, V, is the vitreous; Ir, root of iris.

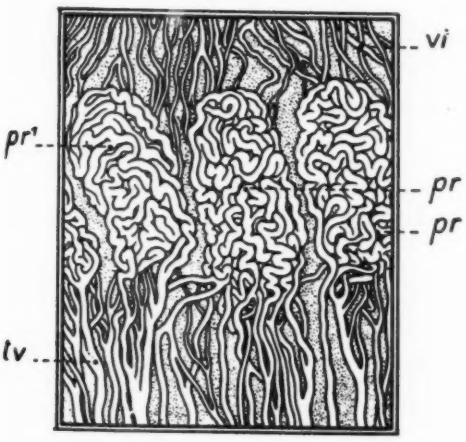

Fig. 15 (Troncoso). The vascular system of the processes in a man's eye (Sappey-Bouin, in Traité d'Ophtalmologie, 1939).

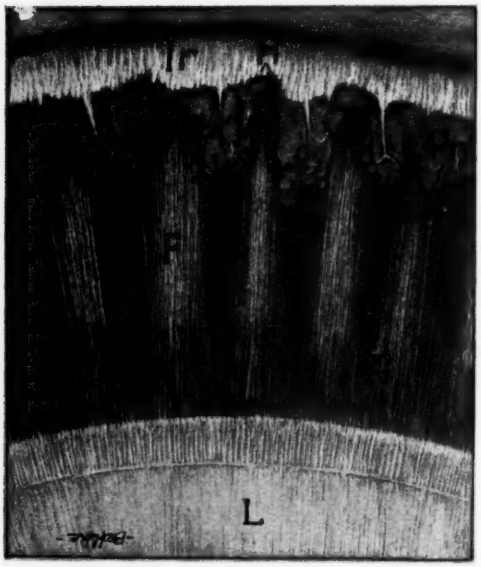

Fig. 17 (Troncoso). Zonula in cattle seen from in front. Formalin specimen. The iris has been removed but stumps of the heads of processes, H, remain fitted into depressions of the zonula, G. Between the heads the membrane forms convexities, F, which line and continue the valleys. The lens, L, is very much retracted; Ir, root of iris.

that dips into the valleys there are some fibers that adhere to the hyaloid membrane and run longitudinally over the valleys roofing them. The arrangement of the anterior and posterior zonular layers is more easily studied in a meridional section (fig. 18, A). They form a triangular structure with its base at the equator of the lens and its apex at the end of the anterior third of the processes, where it dips into the valleys. In cattle, the space between the two layers is entirely filled with numerous fibers that are all attached to the equator. There are no fissures nor spaces between them. This strong suspension is necessary on account of the weight of the lens. As in rodents, the anterior part of the processes and the heads remain outside the zonula, in the extrazonular portion (fig. 23, Ex), while the slopes and the val-

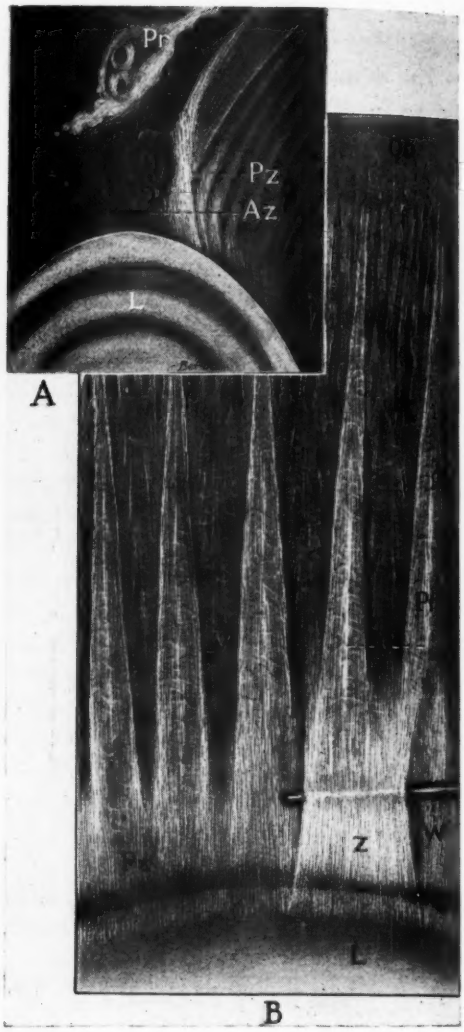

Fig. 18 (Troncoso). Zonula of cattle stained with Flemming's solution. A: Meridional section passing exactly through a valley. The anterior, Az, and posterior, Pz, zonular layers rise from the lens and, forming a triangular structure, meet at the bottom of the valley, where they become attached to the processes. They continue upward lining both slopes until they end at the apices.

B: Dissection of the zonula in the same eye. Seen from behind. The posterior layer, Pz, forms a continuous membrane which dips into the valleys, V, and lines the crests and slopes. A thin probe, W, introduced between the two zonular layers and raised shows well the continuity of the membrane.

leys lined by this membrane form the intrazonular portion.

The hyaloid, Hy, directly lines the posterior zonular layer and then runs back like a roof over the depression of the valleys until it reaches the apices of the processes, where it lines the orbiculus.

DISSECTION: The best way to demonstrate the structure of the zonula is to place the specimen dyed with Flemming's solution upon the dry stage and to anchor it firmly with pins or tacks. Working always under the microscope, the hyaloid membrane is first entirely removed, beginning at the portion over the lens and detaching it toward the ora. When the yellow zonular fibers clearly appear, a hook made of a fine glass rod or a hypodermic wire is introduced near the equator under both zonular layers and then gradually lifted over (fig. 18, B). The zonula is stretched, and spreads over the hook, clearly showing its membranous nature. The membrane is seen to be composed of fibers bound together with a transparent substance. It covers the crests of the processes and between them dips down, lining both slopes of the valleys to their floor. By lifting the hook the membrane is gradually detached from the crests and slopes and its insertion into the processes is easily detected. When it reaches the apices of the folds the fibers become isolated and terminate upon the sides of the apices. The hook may be inserted between both zonular layers near the equator and then gradually lifted over. The layers remain separate until they reach the first third of the process, where they merge and together spread over the crests and valleys.

AIR INFLATION: The older anatomists placed the tip of a very fine glass tube inside the zonular layers in human eyes and, blowing into it, saw the air bubbles run back between the zonula and the hyaloid, as far as the region of the ora serrata. They called the space filled by the air "Petit's canal," and, on account of its rounded edges near the ora and the ribs over the crests, compared it to a French

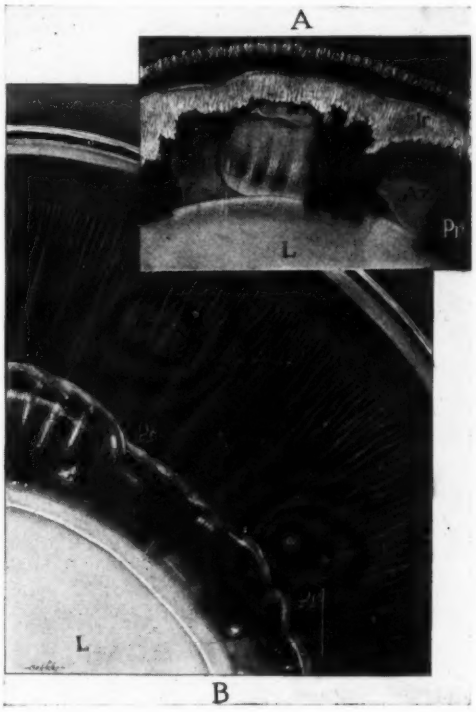

Fig. 19 (Troncoso). Inflation of air in a cow's eye. A. Seen from in front after detaching the iris. Ir, iris root; Pr, stumps of the processes; Az, zonular layers raised by the air bubbles; L, lens. B. Ciliary body of the same eye seen from behind. Or, ora, serrata; Ob, orbiculus ciliaris; Pr, processes; Ab, air bubbles spread between the lens, L, and the processes and covered by the zonular fibers and the hyaloid membrane. The broken heads of the processes (as they are in the front A) appear through the bubble as empty spaces.

silver dish or tray (canal godronné). If the same experiment is tried on cattle eyes (fresh or formalin fixed), puncturing the zonula from behind or from in front, the air bubbles invariably spread behind, between the posterior zonular layer and the hyaloid. However, instead of reaching the

orbiculus, they are always confined to a ring around the lens whose external limit corresponds to about the end of the anterior third of the length of the processes (fig. 19). The ring of air bulges considerably, the hyaloid membrane taking the shape of a sausage. Its rounded external border has in places a straight outline, while in others it shows the rounded edges of the individual air bubbles. There are no conspicuous ribs corresponding to the crests, as in man. It is difficult to understand why in cattle the air bubbles never reach the orbiculus; probably there is a firm adhesion between the hyaloid and the direct fibers of the zonula at the level of the merging of the two zonular layers. In microscopic sections the air is always seen to have spread between the triangle of the zonular fibers and the anterior surface of the hyaloid membrane, but there is some infiltration of air at the valleys, spreading far behind to the orbiculus. In cattle no inflation can be made between the two zonular layers—that is, in the so-called Hanover space of man. In man, I have never been able to find the semiviscid, gelatinous substance between the zonular layers, described by Beauvieux, Duke-Elder, and others.

C. Carnivora

In Carnivora the topography of the zonula is different from that of the rodents and the Ungulata, due to the normal separation between the heads of the processes and the equator of the lens. The zonula becomes directly exposed to the posterior chamber proper and forms a part of its posterior wall. It hangs vertically, and the heads of the processes are directly above the equator of the lens (figs. 10 and 24). In the fresh eye of the cat (fig. 9), the zonula is almost invisible from behind, the distance between heads and equator being very narrow. By indirect illumination, however, it can be seen as a faint membrane with a fine fibrillation. The fibers are finer than in Ungulata and their arrangement is similar to that in the lower mammals, although they are perhaps longer in size. As the accommodation is more powerful and active in Carnivora, the lens must be maintained in a more compressed state at rest, whereas during accommodation the relaxation of the zonula and consequent bulging of the anterior capsule must be increased.

From their insertion into the equator the anterior and posterior zonular layers cross to the processes in a compact, triangular bundle (fig. 24). The two delicate membranes join at the level of the anterior third of the processes, cover the crests, and dip together into the valleys as in the Ungulata. In the valleys, they run backward lining the slopes on both sides until they reach the apices, where they split and become inserted into the orbiculus ciliaris. There are in addition some direct longitudinal fibers that run over the crests and roof the valleys, where they are attached to the hyaloid membrane. In a meridional section the zonula appears as a compact bundle with no perilenticular space.

In the eye of the lion (fig. 10) the course of the zonular fibers was beautifully shown, but they appear crossed and dislodged as the lens was gently pushed back and the drawing made slightly from in front. The longitudinal fibers appear very clearly; the posterior layer is seen by transparency as in the Ungulata. The portion of the heads and sides of the processes which remains outside the zonula (fig. 24, Ex) is called the "extrazonular" part, while the surfaces lined by the membranes forms the intrazonular portion (Iz).

AIR INFLATION IN THE DOG: By means of a syringe with a fine hypodermic needle

attached, air was gently blown between the zonular fibers from behind. As in cattle, air bubbles spread between the hyaloid and the zonular layers, stopping at the level of the heads. Nothing similar to the "canal godronné" was ever observed. There were some small bubbles in the valleys but they could not detach the zonular membranes higher up.

D. Primates and Man

In primates the zonula is built along the same lines as in Carnivora. The thinner, more delicate zonular fibers are bound together by a transparent cement substance. Thus the mechanical effect upon the lens is increased by combining the action of all fibers.

Monkey

In the monkey the space between processes and lens is larger than in the Carnivora. The lens is smaller and lies a little more posteriorly in relation to the heads.

There are two zonular layers, the anterior and the posterior. They come together at a much higher level than in the Carnivora at the beginning of the upper third of the length of the processes (fig. 25). In this way a greater separation is produced between the two layers and a new space is established, the perilenticular space. Examining the zonula from behind, the tentlike insertion into the equator, found in the Ungulata, is missing (fig. 18, A). The fibers run vertically and spread in front of the processes, meeting them higher up, as has been explained. In old specimens the fibers mass in bundles and are attached to each side of the process, dipping down until they reach the bottom of the valleys. There are usually fissures between the bundles. In fresh specimens, however, the posterior layer forms a homogeneous film which covers the crests and dips into the valleys lining their slopes from their lateral insertion to the end of the processes. Beyond these the fibers become isolated and cover the orbiculus up to their insertion near the ora serrata. The anterior fiber layer when examined from in front also shows its membranous nature. It is separated from the tip of the heads by a space which in man Kuhnt called the "recessi camera posterioris." This space is especially noticeable in a meridional section (fig. 25, K), where the vertical course of the anterior layer, the oblique course of the posterior, and the perilenticular space crossed by the equatorial fibers are clearly apparent. The

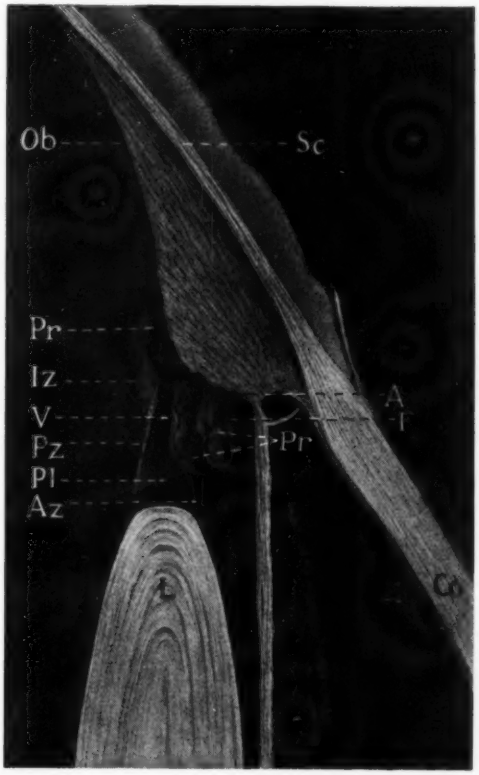

Fig. 20 (Troncoso). Zonula in a monkey's (Rhesus) eye. Meridional section stained with Flemming's solution. The section runs through a valley, V, Sc, sclera; A, iridociliary angle; Co, cornea; Ir, iris; L, lens; Ob, orbiculus ciliaris; F, ciliary front; Pr, processes; Iz, intrazonular surface of process; Pz, posterior zonular layer; Az, anterior zonular layer.

heads of the processes and part of the slopes of the valleys that remain in front of the zonula, Ex, are, as in the Carnivora, the extrazonular surface of the processes. The fibers of the anterior layer merge with those of the posterior layer at the end of the anterior two thirds of the processes. As these are short, the part of the valleys lined by the zonula (intrazonular por-

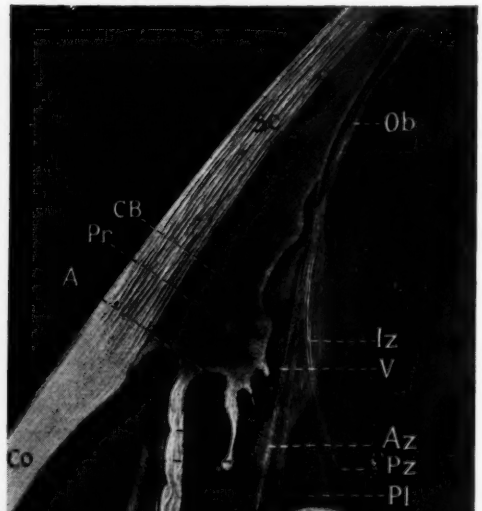

Fig. 21 (Troncoso). Zonula in a human eye. Meridional section passing through a valley, V. Stained with Flemming's solution. The letters have the same meaning as in the previous figure. Az, anterior zonular layer; Pz, posterior zonular layer; Pl, perilenticular space; Ex, extrazonular surface of processes; Iz, intrazonular surface; Pch, posterior chamber.

tion) is smaller than in lower mammals. On the other hand, the length of the zonular fibers from the orbiculus to the ora is about equal or perhaps longer than the length from the equator to the insertion on the valleys. In sections stained with Flemming's solution, the course of the zonular fibers is clearly recognized by its beautiful yellow color and the glistening membrane. In a meridional section (figs. 20 and 25) the perilenticular space has a triangular shape. Beginning with a wide base over the equator of the lens, it runs high up to its apex at the union of the two zonular layers. It is crossed vertically by isolated strands, called equatorial fibers, which either insert themselves into the equator or become displaced and join either the anterior or posterior bundles. In some places they are entirely absent so that a true cavity results between the partitions made by the fibers. The insertions of both the anterior and posterior layers over the lens are similar, but the anterior lies farther toward the pole than does the posterior.

AIR INFLATION: If, with a syringe, air is injected through the posterior zonular layer, the bubbles are seen to spread between the equator and ora serrata, following the valleys. Their border near the ora has the rounded shape called by Petit "canal godronné." There are adhesions of the membrane over the crests, thus forming separate sectors ending in curved, hemispheric edges. Microscopic sections show that the air spreads between the zonula and the hyaloid membrane, the so-called Petit space.

MAN

The anatomy of the zonula appears to be very complicated according to the histologic descriptions found in monographs and treatises. This is due to the fact that microscopic sections have been exclusively used to follow the course of the individual zonular fibers. Nothing, however, can give so adequate an idea of the structure of the zonula as the stereoscopic pictures seen with the slitlamp in fresh human eyes. In the first place, the appearance of fibers is not so conspicuous as in old specimens, where the retraction of

lens and processes stretching the zonula makes the fibers strikingly visible. The old anatomists from Zinn to Kölliker considered the zonula to be a delicate membrane. This concept was changed by the histologic methods using fixed, mummified eyes, in which only the fibers were visible, while the interfibrillar cement had entirely disappeared. It is evident, however, that the fibers are the anatomic foundation of the structure, the thin transparent interfibrillar cement which binds them together being necessary to unify the mechanical power of traction during the period of rest in the lens.

In man, as in the monkey, the zonula is composed of two principal layers: anterior and posterior (fig. 21), widely separated at the equator of the lens. Between them is left a space that in a meridional section has a triangular shape, the perilenticular space (Pl). It is vertically crossed by intermediate strands called the equatorial fibers. The distance between the processes and the lens equator is larger in man than in the monkey (figs. 21 and 26). The anterior zonular layer is inserted into the anterior lens capsule much more centrally than in lower mammals, thus having a greater mechanical action over the capsule, which it keeps tightly stretched during the rest period. The posterior zonular layer is inserted into the posterior lens capsule a little more peripherally. Both insertions are lineal, the triangular shapes described as the attachments of each fiber being found only in old specimens.

From the lens both zonular layers run separately until they reach the upper third of the processes, where they meet and become inserted into the slopes on each side of the processes (fig. 26, i). Examining the zonula from behind (fig. 17) the fibers appear as a continuous structure which, starting at the equator covers the heads of the processes uniformly in the same plane, while in the valleys it dips to a certain point, lining the slopes on each side almost to the base of the depression. When there are secondary folds of plica ciliaris the fibers are probably inserted into them individually. The course of the fibers is beautifully seen when they are stained with Flemming's solution. They can be easily followed from the processes over the whole extent of the orbiculus ciliaris, where they appear as parallel, brilliant yellowish, individual fibers, which run to their insertion over the pigment ring bordering the ora serrata.

If the zonula is examined from in front (fig. 12) the fibers that leave the equator of the lens form a continuous membrane that passes behind the apices of the processes, leaving the heads entirely free in the posterior chamber. In this way an angle or recess is formed, which Kuhnt called "recessi camerae posteriori" (fig. 26, K). Following up the course of the anterior layer in a meridional section passing through a valley (figs. 21 and 26) the fibers are seen running directly along the bottom of the groove until they reach their point of insertion into the process (at i), where the anterior joins the posterior layer. Their common course is short, for the processes are small in size. Where they end, the zonula divides into isolated fibers which can be easily followed through the whole width of the orbiculus to their insertion near the ora serrata. The portion of the processes that is free in front of the anterior layer or extrazonular portion (Ex) is probably larger than in lower mammals, considering the smaller size of the processes, while the intrazonular portion is smaller, although it is prolonged posteriorly by a chink between the orbiculus and the hyaloid membrane.

Besides the two layers and the equatorial fibers, there are several bundles of isolated strands which are called "associated fibers." Not all the fibers arising

from the orbiculus reach the lens. Some of them, the "orbiculo-ciliaris" of Czermak, run from the orbiculus to the sides of the heads. Others designated as "interciliary fibers" course between one head and the next, joining them and strengthening the corona ciliaris. A third variety of fibers proceeds directly into the vitreous (Salzmann, Campos). There are others which arise from the hyaloid membrane and go to the posterior layer of the zonula, coursing directly over the crests. These can be seen with the slitlamp when the hyaloid is detached from the processes under the microscope.

DISSECTION: The membranous nature of the zonula can be demonstrated in man, as Beauvieux first pointed out, by inserting a fine hook into the posterior layer between the fibers and sliding it behind them. I have described this experiment in cattle (see page 21). Although much finer than in the latter, the human zonula can be cut through with scissors. On its sides the aperture shows the thin section of a membrane. With the hook the posterior layer can be raised and then detached from its insertion into the slopes of the valley processes.

AIR INFLATION: The earlier anatomists described as a permanent canal, which they named "Petit's canal," the space between the posterior layer of the zonula and the hyaloid membrane. By injecting air slowly a flowerlike appearance called "canal godronné" is produced over the posterior part of the ciliary body. The injected air fills the perilenticular space, breaks through the posterior layer, and spreads into the valleys and then between orbiculus and hyaloid membrane. At the orbiculus the normal continuity between the structures is looser than in the Ungulata, and the inflated area reaches almost to the ora serrata. The so-called Petit's canal is only a narrow fissure, probably filled with aqueous under normal conditions. Some observers have succeeded in inflating separately the perilenticular space which they call "Hanover's space."

Fig. 22 (Troncoso). Meridional section of a rabbit's eye passing through a valley and showing the relation of the structures in the posterior chamber and lens (semischematic). Co, cornea; Sc, sclera; Pl, pectinate ligament; I, iris; Pch, posterior chamber proper; M, membranous extensions crowded together in front of the edge of the equator of the lens and zonula; R, ridge formed by the apices of the heads; Pz, posterior layer of the zonula running upwards and dipping into the valleys. Both layers meet at the point, i, at the end of the anterior third of the processes and from this point course together to the orbiculus and ora. Some fibers are seen stretching over the crests. Ora, ora serrata; L, lens; Hy, hyaloid membrane; Ex, extrazonular part of the processes; Iz, intrazonular space; A, iridociliary angle; P, pupil.

Fig. 23 (Troncoso). Meridional section of a pig's eye, passing through a valley (semischematic). Co, cornea; Sc, sclera; I, iris; Pl, pectinate ligament; A, iridociliary angle; F, ciliary front; R, ridge of the processes; Az, anterior zonular layer; Pz, posterior zonular layer; L, lens; Ora, ora serrata; Hy, hyaloid membrane; i, point of insertion of zonular layers into processes; Ex, extrazonular portion of processes; Iz, intrazonular space; P, pupil; Pch, posterior chamber proper.

Fig. 24 (Troncoso). Meridional section of a cat's eye (semischematic). Co, cornea; Sc, sclera showing the cavities of the Hovius plexus; Si, ciliioscleral sinus; Pl, pectinate ligament; I, iris; P, pupil; F, ciliary front; Az, anterior zonular layer; Pz, posterior zonular layer; L, lens; Ora, ora serrata; Pch, posterior chamber; Hy, hyaloid membrane; Ex, extrazonular position of processes; Iz, intrazonular space; D, fibers stretching over the crests; N, scleral spur.

Fig. 25 (Troncoso). Meridional section of a monkey's (Rhesus) eye passing through a valley (semischematic). The letters have the same meaning as in the previous figures. PL, perilenticular space; K, recessi camera anterioris (Kuhnt).

Fig. 26 (Troncoso). Meridional section of a human eye passing through a valley (semischematic). The letters show the structures as in previous figures. A, iridociliary angle; F, ciliary front; K, recessi camera anterioris; Pe, space of Petit.

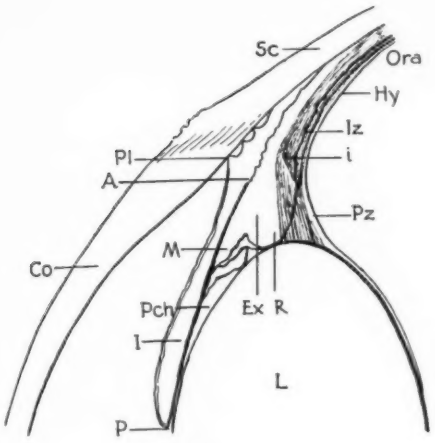

FIG. 22

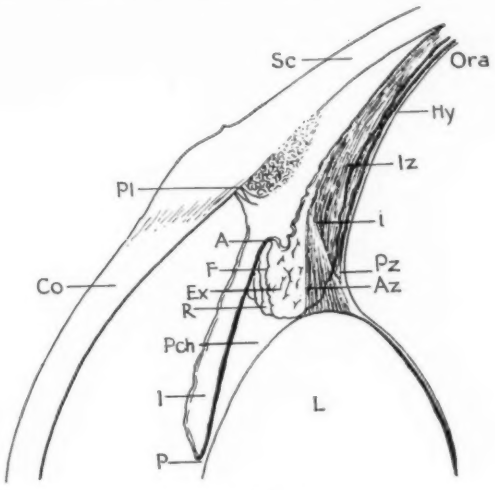

FIG. 23

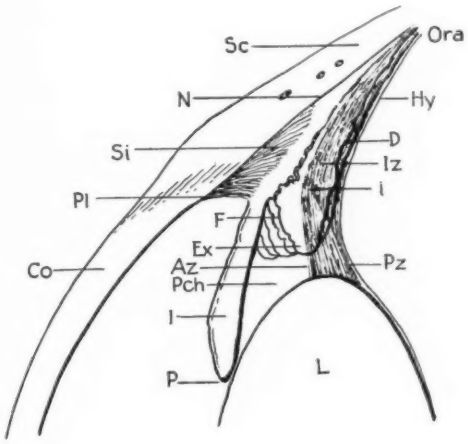

FIG 24

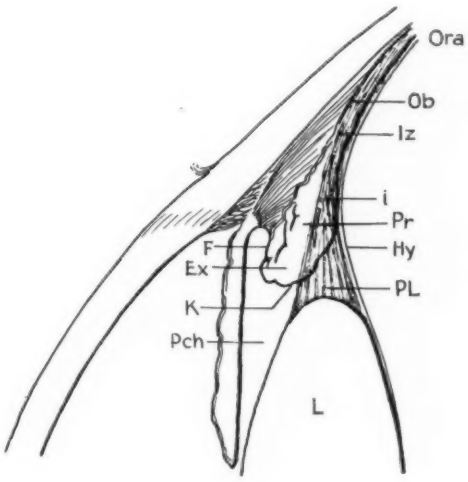

FIG. 25

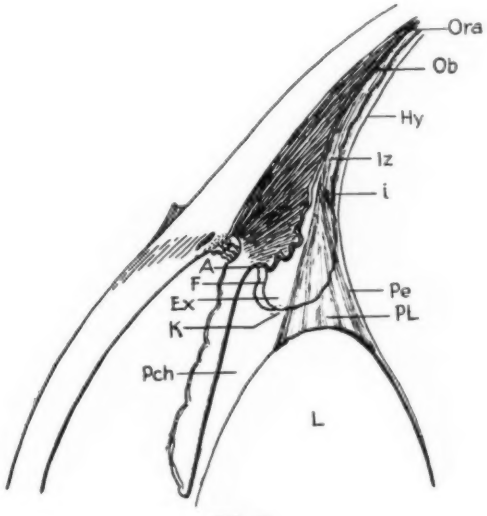

FIG. 26

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According to some authors (Merkel, Beauvieux, Duke-Elder) this space is filled with a homogeneous viscous material, similar to the vitreous in consistency. In the lower mammals, in the case of which the fibers are crowded and there is no space between the zonular layers, this viscous substance does not exist. I have tried to obtain it by aspiration with a syringe from in front, but with negative results. As to man, I am not able to give an opinion; unfortunately, my human specimens were not very fresh.

III. THE POSTERIOR CHAMBER

This cavity has a great physiologic importance in relation to the production and circulation of the aqueous. Contrary to the accepted views, it differs considerably in the different types of mammals on account of the varied relationships between processes and lens.

Rodents. As stated before (see page 8) the lens is suspended not below but behind the processes. The heads and membranous extensions are in contact with the anterior surface of the lens below the equator (fig. 22). Thus the posterior chamber can be divided into two parts: (1) the posterior chamber proper including the extrazonular portion; and (2) the retrociliary or intrazonular space.

(1) The posterior chamber proper is limited anteriorly by the posterior surface of the iris (fig. 22), posteriorly by the anterior lens capsule; below its boundary changes with the movements of the pupil over the lens; above it ends on the massed membranous extensions, M, which form a compact ring around the heads of the processes. This ring presses upon the anterior surface of the lens (fig. 5), thus making of the posterior chamber proper (fig. 22, Pch) a closed cavity. This anatomic character sharply differentiates the posterior chamber in the rabbit from similar spaces in all mammals, including man. The extrazonular portion of the processes, Ex, scarcely communicates with the posterior chamber proper, Pch, through the valleys and the interstices between heads and membranes on one side and the lens surface on the other.

(2) The retrociliary or intrazonular portion of the processes, Iz, does not communicate directly with the posterior chamber proper. The fluid secreted by the posterior two thirds of the processes is stored in the channels made anteriorly by the upper part of the valleys, while posteriorly these channels are roofed by the hyaloid membrane, Hy, and vitreous. The fluid in these narrow spaces cannot pass to the posterior chamber proper except by osmosis through the zonular membrane. The stored fluid may in time also develop certain pressure and transform the virtual fissure into a true space, the so-called Petit's canal. In the rabbit there is no space between the anterior and posterior zonular layers.

Ungulata. As there are no membranous extensions in the Ungulata the ciliary front, F (figs. 7 and 2), is directly exposed to the posterior chamber. This forms a wide cavity that may be divided into two parts: (1) the posterior chamber proper, and (2) the retrociliary or intrazonular space.

(1) The posterior chamber proper is limited anteriorly (fig. 23, Pch) by the posterior surface of the iris from the iridociliary angle, A, to the pupillary border; posteriorly by the anterior lens surface, and above by the compact wall of the ciliary front, F, and the extrazonular portion of the processes, Ex. The ciliary front probably secretes the greater part of the aqueous and this fluid falls immediately into the posterior chamber. Aqueous is also formed at the inner surface of the heads and comes into the valleys in their free portion in front of the anterior zonular layer.

(2) The retrociliary or intrazonular portion of the processes is bounded anteriorly, first by the posterior layer of the zonula, Pz, from the equator to its insertion at the bottom of the valleys, i, where it joins the anterior zonular layer and continues upward through the shallow grooves of the valleys until it reaches the apices of the processes. Beyond these the hyaloid membrane is in contact with the narrow strip of the orbiculus until it reaches the ora serrata. Posteriorly, the retrociliary space is limited by the hyaloid membrane, Hy, which roofs the valleys, thus forming channels that communicate with each other only near the equator. The fluid filling these channels must flow downward, passing into the posterior chamber proper only by osmosis through the zonular membrane. As this is much thicker than in the rabbit the amount of aqueous flowing forward must be small. In normal conditions the canal or space of Petit is probably virtual. There is no perilenticular space, for the zonular fibers are thickly massed at the triangular-shaped zonular insertions to the lens.

Carnivora. The separation of the heads of the processes from the lens entirely changes the anatomic arrangement of the posterior chamber, leaving the anterior zonular layer free and making it a part of the posterior chamber proper (fig. 24). To understand the complicated architecture of this cavity it may be divided into two parts: (1) the posterior chamber proper including the extrazonular portion of the processes; and (2) the retrociliary portion, including the intrazonular spaces.

(1) Anteriorly the posterior chamber proper, Pch, is bounded by the posterior surface of the iris to the pupil; posteriorly, the anterior surface of the lens and the anterior zonular layer, Az, up to its insertion into the inner side of the processes at i. Above, the ciliary front, F, instead of being a solid wall shows a series of blades separated by deep valleys that empty directly into the posterior chamber, and remain outside the zonular membranes (extrazonular space). The slanting anterior edges of the blades increase the volume of the cavity. Thus the heads which are the most important secreting part of the folds pour the aqueous directly into the posterior chamber.

(2) The retrociliary space is limited anteriorly and below by the posterior zonular layer, Pz, which runs upward until it meets the posterior layer at its insertion, i, into the bases of the valleys. From this the single zonular membrane lines the crests and valleys and continues upward to the orbiculus ciliaris. Posteriorly, the retrociliary space is limited by the hyaloid membrane, Hy, and the direct zonular fibers, D. Both roof the valleys and form grooves or channels which end below at the cul-de-sac of the zonular membrane. The fluid filling these channels should pass into the posterior chamber proper by osmosis and perhaps by hydrostatic pressure when the fluid accumulates there. There is no perilenticular space, for the fibers entirely fill the triangle between the two zonular layers.

Primates. Monkey. As the lens is suspended directly from the upper third of the length of the processes (fig. 25) the anterior two thirds remain outside the zonular membrane, while in the Carnivora the zonular insertion leaves only the anterior third free. On account of the formation of a perilenticular space, we must consider: (1) the posterior chamber proper, Pch, including the extrazonular space, Ex; (2) the retrociliary or intrazonular fissure, Iz, and (3) the perilenticular space, PL.

(1) The posterior chamber proper, Pch, is a wide cavity with the same boundaries as in the Carnivora. However, the posterior wall is longer, as the space be-

tween lens and zonular insertion to the slopes (fig. 25, i), is greater. This makes the extrazonular portion of the processes, Ex, larger, for not only the ciliary front, F, but the greater part of the slopes of the valleys is included in it. For this reason although the processes are shorter the vascular surface is increased.

(2) The retrociliary or intrazonular space, Iz, includes a series of grooves where the zonula dips into the valleys. Starting at the point i, where the two zonular layers meet, it continues as a capillary fissure between the zonula and the hyaloid membrane, Hy, throughout the whole breadth of the orbiculus, up to the ora serrata. The orbiculus is covered with the long, parallel, isolated zonular fibers that run to the ora serrata. The fluid formed in this fissure probably runs along the posterior zonular layer and may pass by osmosis through it to the third space.

(3) The perilenticular space, PL, has a prismatic shape. As stated before, there are empty spaces between the equatorial fibers, so that a continuous, tortuous cavity is formed, the Hanover canal.

Man. The posterior chamber in man is similar to that of the monkey and may be divided also into three parts: (1) the posterior chamber proper (fig. 26, Pch). This is a large cavity that includes not only the space between the iris and the lens-zonula, but also the extrazonular, Ex, surface of the processes. The latter includes not only the ciliary front, F, which is the richest in capillaries, but all the surface of the mouths of the valleys and the secondary processes. Their secretion is probably large and falls directly into the posterior chamber.

(2) The retrociliary or intrazonular space, Iz, actually starts at the point i, where the posterior layer of the zonula meets the anterior layer. From there the zonula dips into the valleys and lines their slopes, forming a series of small radiating grooves. These end with the processes, and the retrociliary space continues as a fissure between the strands of the zonula and orbiculus on one side and the hyaloid membrane on the other, the so-called canal of Petit. As in the monkey, fluid formed in the retrociliary space probably passes by osmosis through the posterior zonular layer to enter the space around the lens.

(3) The perilenticular space, PL, is wider than in monkeys and its cavity is filled with fluid. It is called Hanover's space and, as stated before, some authors (Beauvieux, Duke-Elder) think it is filled with a semiviscoid substance similar to the vitreous, which as a gel will be a medium of fluid exchange between the posterior chamber and the retrociliary space.

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635 West One Hundred Sixty-fifth Street.

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AQUEOUS VEINS*

Preliminary note

K. W. Ascher, M.D.
Cincinnati

The site of exit of the intraocular fluid has been discussed for many decades. The classical view elaborated by Leber[1] is that the aqueous humor has a definite primary circulation, the fluid arising from the ciliary body and leaving the eye by the canal of Schlemm. An opposite view was promulgated by Magitôt, by Hamburger, and by others,[2] who maintained that there was little or no passage of fluid in this sense, but that a general metabolic exchange took place throughout the tissues of the eye. A third view, reconciling these two theories, was advanced by Duke-Elder[3] whom I am quoting, in this paragraph, almost literally. He deduced the presence of a metabolic interchange between intraocular fluid and blood through the capillary walls throughout all the tissues of the eye and superimposed upon this a secondary pressure circulation conditioned by the pulse beat, the respiratory variations, and muscular activity.

Numerous investigators have tried to find the pathways of the outflowing aqueous humor by injecting different materials into the chambers of the eye, but intraocular injections will never compare with the normal pressure equilibrium. E. Seidel[4] injected indigocarmin or India ink into the anterior chamber of rabbit eyes after withdrawing a part of the aqueous humor; the injected-fluid volume was smaller than the amount of aqueous aspirated before injection. Seidel observed entrance of the colored fluids into the episcleral vessels before the intraocular pressure reached its former level. These dye injections are the only animal experiments paralleling partially the findings in living human eyes to be discussed in this paper.

Lauber's[5] observations in animal experiments point in the same direction without giving evidence of a visible outflow of ocular fluid into conjunctival veins. He found that blood, collected from a pericorneal conjunctival peritomy, was markedly diluted in comparison to blood taken from blood vessels elsewhere in the body. He interpreted this difference as favoring Leber's theory, which is, in my opinion, to a great extent confirmed by my own observations.

Using the corneal microscope and illumination by the modified Gullstrand slit-

* From the Department of Ophthalmology, College of Medicine, University of Cincinnati, Dr. Derrick Vail, director. Received for publication July 12, 1941.

lamp of the Bausch and Lomb unit, I have been able to see in human eyes blood-vessellike structures containing highly diluted blood, or a fluid clear as water, and leading from the limbus or the paralimbal region towards the equator of the bulbus, and finally emptying into the conjunctival or episcleral vessels. Repeated investigation favors the conclusion that these structures have to do with the elimination of intraocular fluid, mixed, in a varying ratio, with blood. In this way, they complete the "exactly adjusted safety valve" (Duke-Elder) of Schlemm's canal to form together an admirable drainage system, intercalated between intraocular fluid on one side and venous system on the other. Both Schlemm's canal and aqueous veins are situated "in the backwater of the venous circulation," but the aqueous veins—this is the name proposed for these structures—are accessible to inspection in the living human eye. The fact of a continuous outflow of intraocular fluid, according to Leber's theory, was not obviously evident prior to the knowledge of these connections between Schlemm's canal and the veins in- or outside the bulbar coats.

All over the body lymph fluid enters into capillaries, but we were not able to observe this process. Even the emptying of the largest lymph vessel, the ductus thoracicus, is observed only in necropsy or after dissection of living tissue. In the limbal region of the living human eye, entrance, and presence, of intraocular fluid into the circulating blood has become visible. Problems of the maintenance and pathology of intraocular pressure may become clear from the consideration of this finding.

Definition

The expression, aqueous veins, or, in Latin, vasa efferentia humorem aqueum is proposed. Aqueous veins are biomicroscopically visible pathways of blood-vessellike appearance, containing a clear colorless fluid or diluted blood, and intercalated, probably via Schlemm's canal, between intraocular fluid on one side, and conjunctival and subconjunctival veins on the other side.

In the early years of slitlamp microscopy, lymph vessels in the pericorneal conjunctiva were described in a number of publications, some of which may have been aqueous veins. Now, I suppose, that the glass-rodlike tubes in the limbal region which I described in 1924, at least some of them, were nothing else than aqueous veins. Loewenstein[7] mentions by way of parenthesis in a recent paper tiny white threads as a part of the reserve vessel system. These threads may be connected with the problem under discussion, but Loewenstein did not proceed to anatomic and physiologic analysis.

Occurrence

Seventy-nine among 295 patients observed in the ophthalmologic service of the Nutritional Clinic in Hillman Hospital, Birmingham, Alabama, showed aqueous veins. This means that during routine examination aqueous veins were easily detected in 26.78 percent of ambulatory patients. There was not always sufficient time to search thoroughly for aqueous veins in every eye; otherwise the percentage would probably have been higher. On the other hand, in some of these patients, the detection of aqueous veins was favored by a slight or marked decrease of red blood corpuscles in the blood. A majority of persons, however, who showed easily visible aqueous veins had a normal erythrocyte count.

The occurrence of aqueous veins is associated with neither sex nor age. The youngest persons with aqueous veins were

7, 8, and 9 years old, and the two oldest were 67 and 72 years of age, respectively. Children younger than seven years were not investigated for this purpose because of the difficulty of keeping them sufficiently quiet.

If an aqueous vein was found in one eye, ordinarily the fellow eye showed one (or more). Also as a rule, the distribution in both eyes of the same person is symmetrical; for example, when in one eye the aqueous vein was seen at the 3-o'clock position the other eye generally had a similar vessel at the 9-o'clock position; but there was not always this strict symmetry, and exceptions occurred the more frequently the farther from the horizontal meridian the vessel was situated. The majority of aqueous veins are to be found between the 1- and 5-o'clock positions, and between the 7- and 11-o'clock positions, the regions 11 to 1, and 5 to 7 showing them only exceptionally.

There is a familial similarity in the location and appearance of aqueous veins: parents and children, and brother and sister sometimes show aqueous veins in identical places, and similar in appearance.

Appearance

Aqueous veins are to be recognized by (1) a pale or even limpid coloration in contrast to the red of ordinary blood vessels, sometimes by stratification, that is, a visible separation of the blood and the clear fluid into two or more layers that parallel the vessel wall; (2) by their more or less characteristic origin, course, and emptying; and (3) by their typical response to certain experimental manipulations.

Where only two lines of differently colored fluids are visible, there almost always is to be found a tributary emptying into just the spot where the stratification begins. One of the joining vessels is paler, the other is darker, and after the junction the pale color continues according to the location of the entrance of the pale vessel (fig. 1A). Sometimes aqueous veins are seen originating with the current already stratified.

Where three layers are visible, the peripheral ones are always of a darker red than is the center. Here, a fairly clear or quite colorless central thread may become visible. The junction of two stratified vessels may produce a quadruple stratification, consisting of two peripheral layers and two paler central layers differing from one another in tint; frequently a quintuple stratification is present following the scheme: dark-pale-dark-pale-dark, but in these cases mingling occurs more commonly a short distance behind the junction.

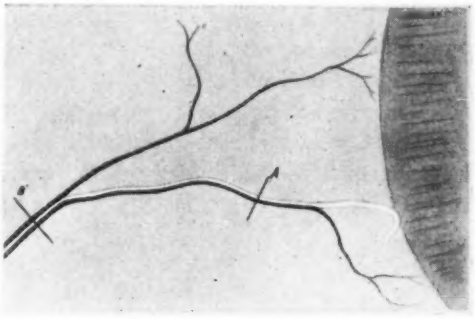

Fig. 1 (Ascher). Origin and course of a typical aqueous vein. Aqueous vein in the left eye of Mr. J. McN. (white, 48 years old). From the lower nasal limbus an aqueous vein starts with an archlike origin and empties into a conjunctival vein coming from the lower bulbar conjunctiva. Below the junction two separate strata are visibie, A, the clearer one being the continuation of the aqueous vein. After joining one more vein the vessel becomes composed of two peripheral red and one pale central layers, B.

At first glance, stratified vessels having three layers look like two narrow parallel vessels divided by a clear interspace, the latter being but the clear central thread. Slight compression is fol-

lowed by destruction of the strata, a lid movement may be sufficient to cause the lines quickly to mingle to form a uniform red stem, somewhat paler in color than ordinary conjunctival vessels; in other cases, after compression a very impressive expulsion of all or nearly all of the red corpuscles takes place until the whole structure looks like a colorless glass rod imbedded in semitransparent china; this may be called "the glass-rod phenomenon." Thus, evidence is given to the fact that there were not two separate vessels but one, apparently divided by a central line of colorless fluid (fig. 1B).

Following the palest tributary of a stratified vessel in a direction opposite to the blood stream I was always able to find, if not the origin of the aqueous vein, at least the spot where it became visible. To use a shorter expression, this spot may be simply called the origin.

Origin of aqueous veins

Three types have been observed, up to the present time. Many aqueous veins near or in the limbus proper form a semicircular or U-shaped arch, one limb of which emerges out of the deeper semitransparent limbal or paralimbal scleral tissue, while the other, more superficial limb reaches the conjunctiva (fig. 1).

Another type of origin is the appearance of an aqueous vein out of a scleral emissarium at some distance from the limbus. The emissaria may have small pigment halos. From the emissarium the aqueous vein runs straight for a short distance through subconjunctival tissue and ascends to the conjunctiva there to join its recipient vessel. Some are imbedded in a shallow trench after their exit from the sclera; these grooves may be called: sulci vasorum efferentium humorem aqueum. Eyes with two or more of these sulci have been seen.

The third type of origin of aqueous veins is less characteristic, so that it is possible to confuse them with the ordinary conjunctival vessels. This third type may be called aqueous vein whose origin is hidden in concentric collaterals of limbal loops. In many eyes, the blood current from single limbal loops does not return individually by the venous limb of each loop to form larger veins which otherwise roughly follow the course of a meridian of the bulbus, but connections are formed continuously from one loop to the next until a relatively large anastomosis is formed running concentrically to the limbus corneae. These concentric anastomoses run very closely to the rim of the scleral margin; by retro-illumination they seem to be situated in clear corneal tissue while direct illumination proves their location in the scleral zone. These concentric collaterals, if present, receive all or at least most of the blood from all adjacent limbal loops to empty it into larger veins usually situated in the temporal or nasal horizontal meridian of the bulbus. As a rule, concentric connections coming from the upper corneal quadrant show a downward-flowing blood current, while those in the lower quadrant flow in an upward direction. Usually the color of the blood column in these concentric connections is somewhat paler than in other parts of the conjunctival vessels, and the flow of corpuscles is more readily observable in these branches than in most of the other conjunctival vessels. Sometimes, starting from a certain spot, the concentric collateral becomes suddenly markedly clearer and, on compression, more colorless fluid enters the concentric connection in a direction opposite to the formerly visible movement of the blood. This means that an aqueous vein joins the concentric connection from out of the scleral tissue or limbus tissue situated just behind the vessel wall (fig. 2).

Between their origin and emptying

aqueous veins usually run a straight course except for the initial loop, which if present, is similar to the arcuate origin of a cilioretinal artery. Even in eyes with marked tortuosity of the episcleral vessels, aqueous veins generally prefer the shortest course between origin and emptying, with enough play in all vessels passing through tissues that are subjected to stretching and shortening.

The length of the biomicroscopically visible part of the aqueous veins is between fractions of millimeters and one centimeter, or slightly more. Some of them can be followed from the limbus to a point beneath the semilunar fold, or to the temporal angle.

The width of aqueous veins is between that of postcapillary conjunctival veins and of larger conjunctival veins; that is, according to Leber,[1] between 0.01 and 0.1 mm.

Vessel walls are not evident, not even after instillation of dionin, which will expand conjunctival tissue to a high degree and in this way show biomicroscopic details not otherwise distinguishable.[8]

The emptying of the aqueous veins

This is at times very characteristic, due to the junction of two currents of different color. Usually, an aqueous vein approaches the recipient vein at a more or less acute angle. After reaching it, the contents of the aqueous vessel is poured into the recipient vessel and in this way the stratified current originates. Mingling of both currents, the watery and the sanguineous, often occurs very slowly so that both fluids may run parallel to each other in the vessel for some millimeters or more without mixing. The appearance suggests the emptying of a clear mountain creek into a muddy river. In some instances, the colorless fluid continues to flow as a central thread, while red corpuscles occupy peripheral layers, continuously or in granular current following the vessel walls. The latter phenomenon, clear central thread and peripheral corpuscle lining, occurs as a rule after the emptying of two ordinary veins into one aqueous vein from two opposite sides

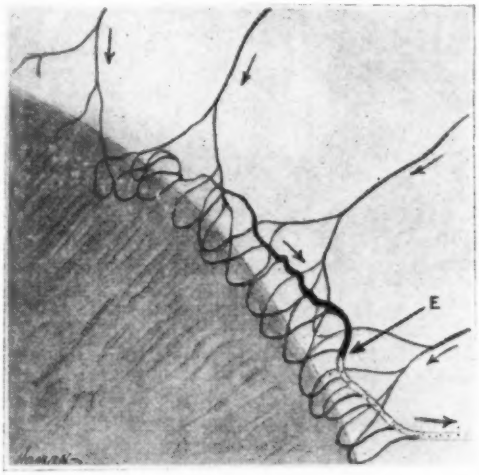

Fig. 2 (Ascher). Third type of origin of aqueous veins. Mrs. V. W., white, aged 52 years. R.E.: There is a concentric limbal anastomosis receiving all blood from the limbal loops. This vein becomes larger the closer it approaches the horizontal meridian and suddenly (at E) its color changes from the usual color of blood to a very pale tint, proving the invisible emptying of an aqueous vein.

(fig. 1). Its resemblance to the possible appearance of Schlemm's canal as described gonioscopically by Uribe Troncoso[9] is interesting and important: a similar aspect may point to similar composition of the fluids in question and to similar function of the observed structures.

Stability of individual aqueous veins

In spite of all the changes that may occur spontaneously in aqueous veins, or may be produced by mechanical, physical, or pharmacologic means, they regain their former appearance after a longer or shorter interval. Any particular vessel, of which a sketch had been made when first

observed, after an interval of hours, days, and even months showed the same qualities as it did at its detection. Differences in stratification or in blood-corpuscle content may occur; the individual aqueous vein with its characteristic origin, course,

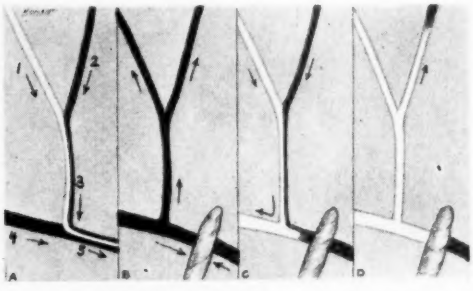

Fig. (Ascher). Compression produces the glass-rod phenomenon. Mrs. V. W. (as in fig. 2). R.E.: Near the nasal limbus a superficial and a deep aqueous vein join for a short common course before emptying into the nasal horizontal conjunctival vein. After compression of the recipient vessel, corpuscles enter the aqueous veins in a retrograde direction (note arrows); no more stratification is visible. But two seconds later, a clear colorless fluid reenters section 1 and section 3 and expels all corpuscles out of section 4 and later out of section 5. Some seconds later, the clear colorless fluid forces its way into section 2, and here, for some minutes, a pulsating borderline between blood and clear fluid is maintained.

and emptying remains the same typical structure on repeated study. On the other hand, ordinary conjunctival or subconjunctival or episcleral vessels which, on compression, did not show the glass-rod phenomenon, never showed it on any subsequent examination.

Response of aqueous veins to mechanical compression

Compression exercised by a very small cotton applicator on an aqueous vein, or on the recipient vessel near to the junction with an aqueous vein, produces characteristic phenomena. Stratification, if present before compression, disappears quickly and the vessel becomes uniform in color and, often, the section situated near the junction becomes clearer than it was before compression started, even quite colorless. If so, this part of the vessel resembles a glass rod surrounded by semitransparent porcelainlike scleral tissue, the glass-rod phenomenon.

But it is not always the emptying of blood corpuscles that is produced by the compression of vessels near the entrance of an aqueous vein. Sometimes the opposite phenomenon is seen: while the current is slowed down, stopped, or even reversed, a colorless tributary may suddenly become filled with corpuscles. After compression has ceased, the blood corpuscles disappear from the tributary.

Anesthesia can usually be avoided in these experiments; most of the persons investigated stand the practically painless procedure without any objection. In very sensitive eyes, instillation of 1-percent butyn solution may be useful, but this drug, like almost all of its type, has an effect on conjunctival vessels as well as on aqueous veins.

Discussion of the fundamental compression phenomenon

The direction in which red corpuscles leave an aqueous vein after compression depends on the available anastomotic pathways and on the relative pressure levels in each of them.

The glass-rod phenomenon becomes visible when the pressure of the clear fluid is higher than that of the blood; when the opposite occurs, blood will enter formerly clear, colorless sections. It may happen that a sharp border between watery and sanguineous phase is maintained in a particular section of the vessel for seconds or minutes, a manometer-like equilibrium being reached between blood on one, and corpuscleless fluid on the other side. In these cases, at the borderline separating the colorless from the sanguineous section of the vessel and

crossing the vessel diametrically, pulsations are nearly always visible.

The pulsating borderline may be shifted during continuous compression to a more distal or to a more proximal spot, according to the changing ratio of pressure in both systems. Finally, the borderline disappears in one or the other direction; the whole vessel becomes filled with corpuscles, or all corpuscles are evacuated and the glass-rod phenomenon appears. Expulsion of red corpuscles is often so clearly visible that no other explanation could be accepted; when, on the other hand, blood is able to overwhelm a less vigorous aqueous stream, clear fluid is repelled perhaps as far as into Schlemm's canal which, at this instant, probably becomes filled with more than the usual number of red corpuscles.

In other words, in the pericorneal venous meshwork there is an anastomosis of vessels from two sources, one source being blood, the other clear, or fairly clear fluid leaving Schlemm's canal. When the free outflow of a vessel section is blocked, the source running under higher pressure will get priority and will remove fluid entering the meshwork from another source running under lower pressure until a new equilibrium has been established. The fact that in some places one, in other cases the other, source gets priority enables us to estimate the pressure present in a particular aqueous vein.

The glass-rod phenomenon, the filling up of an aqueous vessel by blood, and the pulsations on the borderline between blood and aqueous in an aqueous vessel are the consequence of different pressures present in the aqueous fluid on one side, and the blood on the other side.

The question arose whether measurable factors may influence the equilibrium of these factors. A relationship could be postulated between ocular tension on one side, and pressure in the conjunctival recipient vessel on the other side. In my material the ratio of aqueous veins with producible glass-rod phenomenon to those which showed the blood-filling phenomenon, was about seven to five. Intraocular pressure values have been found equally distributed over both groups; hence, intraocular pressure as an absolute value has no influence on the presence or absence of the glass-rod phenomenon. It may, however, influence this phenomenon in comparison with the pressure in the recipient vessels.

Summary

Biomicroscopically visible vessels were observed in the limbal and paralimbal region of living human eyes, containing highly diluted blood or a clear colorless fluid and emptying into the conjunctival and subconjunctival venous meshwork. I would suggest that these vessels be called aqueous veins, and define them as biomicroscopically visible pathways of blood-vessellike appearance, containing diluted blood or clear fluid, and intercalated, probably via Schlemm's canal, between intraocular fluid and conjunctival and subconjunctival veins.

Aqueous veins are recognized: (1) by their more or less characteristic origin in or near the limbus corneae, or out of an emissarium sclerae; (2) by lack of blood corpuscles as compared to ordinary conjunctival and subconjunctival vessels and, sometimes, by a typical stratification; (3) by their characteristic emptying into recipient vessels; and (4) by significant phenomena produced by compression of their recipient vessels.

Duke-Elder's description of Schlemm's canal as lying in the backwater of the venous circulation has been supported; the aqueous veins together with the "exactly adjusted safety valve" of Schlemm's canal form an admirable drainage system.

The detection of aqueous veins has given obvious confirmation to the fact of a continuous exit of fluid consisting, at least partially, of aqueous humor from the intact living human eye. Continuous formation of intraocular fluid is postulated at least to the degree covering the amount leaving the eye by the aqueous veins.

There is no need to search for anatomic substrata in order to understand the function of the aqueous veins; Schlemm's canal on one side, the surrounding vascular meshwork on the other side, and, between them, the anastomosing intrascleral vessels give a sufficient anatomic foundation for the observed fluid elimination.

The physiologic and the pathologic importance of the aqueous veins will be discussed in a later publication.

I should like to take this opportunity to express my thanks to Dr. Tom D. Spies for placing the clinical material in the Nutritional Clinic, Hillman Hospital, Birmingham, Alabama, at my disposal; furthermore, to Dr. W. B. Bean, to Dr. W. R. Vilter, and to Miss Virginia Minnick for providing the internal medical and laboratory data of the patients.

411 Oak Street

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THE EARLY DIAGNOSIS OF CHOROIDAL MELANOMAS*

BENJAMIN RONES, M.D.
Washington, D.C.

The importance of the early diagnosis of malignant melanomas of the choroid lies in their high mortality rate. According to Wilder and Callender,[1] 49 percent of the patients in their reported series of 253 cases were dead within five years after diagnosis. Enucleation is the only treatment for this condition, and the earlier its identity is fixed the sooner the eye can be removed, and thus the possibility of metastasis be minimized. However, it is not an easy matter to detect these tumors in their earliest stages, for they do not produce a clear-cut clinical picture and often simulate less serious ocular disease.

Pathologists[2] have described the evolution of the choroidal melanomas in four stages. In the first the tumor is flat, compressed in the choroid between the tough lamina vitrea and the sclera. In the second stage, the lamina vitrea is broken at one point and the tumor proliferates through this opening, forming a nodular mass attached by a neck to the choroidal base, and covered by the detached retina. The third stage develops when the tumor ruptures through the sclera forming extraocular nodules. In the last stage metastases occur in various parts of the body. Convenient as is this classification, the tumors rarely conform to this pattern; consequently, clinicians[3] have developed their own formula of the four stages of choroidal melanoma evolution. The first is a symptomless stage, followed by the second stage of glaucoma, the third of extraocular extension, and finally by generalized metastasis. Again it should be noted that comparatively few of these tumors follow these schemata. To await the development of these stages is also dangerous, since the sequence of events is not an invariable one. Thus the intraocular tension may never be elevated, or extraocular nodules may develop before the tension becomes elevated, or generalized metastases may occur even in the initial stages. The aim should always be to detect these tumors in their very earliest states. This is at times extremely difficult, as is seen in Terry and Johns's[4] study of 94 cases, in which the presence of a tumor was not even suspected clinically in 44.6 percent.

There are no definite symptoms to aid in early detection. Indeed, symptoms may be entirely absent until generalized metastases occur. If the macula is the region first involved, the early disturbance of central vision will quickly bring the patient to the physician. However, when the growth occurs elsewhere, there are no visual disturbances until the retinal detachment becomes quite extensive.

A common manifestation is the occurrence of secondary glaucoma, and all too frequently the physician waits until this takes place before making his diagnosis. It is true that a large number of cases do show an increased intraocular pressure at some stage. Nevertheless this is a relatively late complication, as has been well pointed out by Dunnington.[5] He studied 55 cases of intraocular sarcoma and found that in 9 of these a definite secondary glaucoma had occurred. Of the remaining 46 cases, the tension of the affected eye was found to be lower than that of the sound eye in 63 percent; in 23.9 percent the tension of the two eyes was equal, while in 13.1 percent the affected eye showed a slightly higher tension. Dunnington concluded that an initial

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drop in the intraocular tension is the rule rather than the exception in the early stages of sarcoma of the choroid and ciliary body. In Terry and Johns's series, glaucoma was present in only 33 percent of the cases. In some of these there was a small tumor that did not appreciably project into the vitreous cavity. With the largest tumors, practically completely filling the eye, glaucoma was almost invariably present. Since glaucoma did not occur in every case in which the tumor had considerably invaded the vitreous, compression of the vitreous was not the entire explanation of an increased pressure. In most cases it is due to circulatory congestion following obstruction of the venous flow from the ciliary body and choroid. There may also be obstruction of the intraocular fluid at the chamber angle, either by neoplastic infiltration or by pigment and cellular accumulations. An acute rise of tension may occur when necrosis of the tumor causes the liberation of histaminelike substances. If the ciliary processes are destroyed by the tumor or by the toxic products of necrosis, hypotony and shrinkage of the globe will occur.

Another frequent manifestation is the appearance of inflammatory symptoms following necrosis of the tumor. Terry and Johns found uveitis to be present in 75 of their cases. In many instances it was manifested by posterior synechiae, but at other times the uveitis was extremely severe and in one case was even diagnosed as panophthalmitis. Samuels[6] has thoroughly described the necrosis and inflammatory symptoms present in these tumors. He noted that chemosis of the conjunctiva and edema of the lids, together with exophthalmos, appeared as expressions of orbital cellulitis. He also found that in 84 cases of choroidal sarcoma, there occurred one indisputable case of sympathetic ophthalmia.

Detachment of the retina occurs with such great frequency in these tumors that all cases of retinal separation should be viewed with suspicion. Thus the retina was found to be detached in 85 out of 91 cases in Terry and Johns's series. It has been pointed out by numerous observers[7] that in detachments occurring over a tumor the retina is smooth and free of undulations, pigment deposits are present, newly formed blood vessels may be seen, and the area of detachment is rather sharply defined. When present these signs are certainly suggestive, but their absence does not rule out the presence of an underlying tumor. Holes in the retina occur in cases of choroidal tumor, but not so frequently nor so characteristically as in the traumatic or "idiopathic" types. Small circumscribed detachments, particularly those occurring in the macular region, should always be viewed with suspicion. Although detachments with elevated intraocular tension are immediately suggestive of underlying tumors, it should be borne in mind that normal and subnormal tensions are frequently found. The extent of the detachment bears no relationship to the size of the tumor, for even small growths may cause an extensive subretinal transudate. Transcleral transillumination should be employed in all cases of detached retina, even though such evidence is not always confirmative, for a hemorrhage or mass of inflammatory tissue may produce a shadow, while a small or nonpigmented tumor may not. In cases involving the posterior segment, the surgeon should not hesitate to operate, introducing the transilluminator behind the globe.

In spite of all such suggestive evidence, it is frequently impossible for the conscientious surgeon to arrive at a positive diagnosis. Further to confuse him, there are several conditions that often mask the

presence of a tumor. Among such are hemorrhagic absolute glaucoma, unilateral uveitis associated with elevated tension, unilateral disturbance of ocular pigment, and particularly blind and painful phthisical eyes.

The following two cases are cited in order to illustrate the difficulties in arriving at a correct diagnosis.

Case reports

Case 1. Mr. B. H. H., aged 73 years, complained that in January, 1931, he first noticed some visual disturbance in the left eye following a throat infection. His oculist treated him until May, at which time a consultant made the diagnosis of detachment of the retina due to an intraocular tumor and advised immediate enucleation. Another consultant disagreed with this diagnosis on the basis of good transillumination and subnormal tension (R.E. 21.1 mm. Hg; L.E. 12.3 mm.) and advised further observation. At this time the vision in the left eye was the ability to detect hand movements in a small field.

He came under my observation on February 27, 1932, at which time the tension in the left eye was slightly elevated. The anterior-chamber angle was obliterated below, and on transillumination a dark shadow could be seen temporally. My diagnosis was malignant melanoma and immediate enucleation was advised. However, consultation was requested with the clinician who had advised further observation, and he concurred in this opinion. Enucleation was performed on March 17, 1932, and one week later it was noted that enlargement of the liver was present. Death occurred four months later.

Microscopic examination of the globe showed extreme edema of the ciliary processes causing the iris to be pressed against the cornea. The retina was completely detached, reaching to the back of the lens. Extending from the disc almost to the ora serrata was a large, oval, heavily pigmented tumor. The lamina vitrea was ruptured at only one point. The tumor had extended to the perivascular and perineural spaces of the sclera, but no epibulbar masses were seen. The tumor cells were of a mixed type, with epithelioid-type cells predominating.

Case 2. Mr. H. P., aged 37 years, had been under the observation of Dr. W. H. Wilmer since childhood because of myopia and an amblyopic right eye. In August, 1934, while shooting, he noticed a "veil" before his right eye. This was diagnosed as a retinal detachment due to trauma. He reported to Dr. Wilmer, who, on October 23d operated upon the eye, using the Walker pins. Only partial reattachment was obtained. Subsequently complete detachment occurred, the vision being poor light perception. The tension was subnormal. The patient remained under frequent observation, and the eye was comfortable. However, in March, 1940, the eye became extremely painful. Examination showed vascular congestion of the globe, edema of the cornea, good transillumination, and marked elevation of tension, without any evidence of uveitis. In spite of frequent miotics the tension remained elevated and the eye painful. Enucleation was advised on the basis that a blind eye which had previously shown a subnormal tension and now developed an elevated tension, was very likely to be the seat of a tumor. This opinion was also shared by my consultant, Dr. Louis Greene, and the eye was enucleated on March 28, 1940.

Microscopic examination of the globe showed atrophy of the ciliary body, and marked gliosis and cystic degeneration of the retina. Extensive chorioretinal scarring was present. A portion of the retina was detached and beneath this was a large hemorrhage containing cholesterin slits. The uveal tract showed varying degrees of chronic inflammatory-cell infiltration. No evidence of a neoplasm could be found.

These two cases well illustrate the points which I should like to emphasize. The first is that it is extremely important to make the diagnosis of malignant melanoma as soon as possible, rather than to wait until the signs are unmistakable for death may result from delay. The second is that it is wise to remove all blind eyes that behave suspiciously, for it is better to remove a number of such sightless eyes and subsequently find that they contain no tumor, than to have even one case slip by and cause a fatality. A mortality rate of 49 percent is a glaring challenge to our knowledge and skill, and anything that lowers this figure marks an advance towards the goal for which we must constantly strive.

1610 Eye Street.

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FAMILIAL INCIDENCE OF RETINOBLASTOMA*

WITH GENEALOGIC CHART

HAROLD F. FALLS, M.D., M.S.†
Ann Arbor, Michigan

Retinoblastoma, a malignant intraocular tumor of infancy and early childhood, frequently displays an outstanding familial character. Numerous siblings of a family may demonstrate the neoplasm or, more rarely, one or several members of successive generations may be afflicted with the malignancy.

It is the purpose of this paper to present observations concerning the occurrence of retinoblastoma in 6 members of a group of 10 siblings of the "N"‡ family.

During the past decade the German medical literature has presented numerous reports on the heredity of many diseases. The Nazi program, devoted to the purification of the Aryan race, has stimulated active investigation of many of the transmissible general and ocular diseases. The hereditary character of retinoblastoma has been a point of controversy, especially since the advocation of sterilization of all individuals affected with this malignant neoplasm. Many authors concur that too little is known regarding the hereditary factor in retinoblastoma to decree dogmatically the sterilization of such unfortunate individuals. Lange[1] and Reiser[2] are of the opinion that sterilization should be reserved for afflicted members of those families in whom an unquestionable trend of transmission of the disease from generation to generation is demonstrated. Reiser emphasizes that over 1,000 cases of retinoblastoma can now be found in the medical literature with survival of almost 50 percent of the patients who have been subjected to surgery. It is estimated that several hundred individuals, recovering from surgical treatment, reach the age of reproduction; yet in only 20 to 25 of the cases reported has there been demonstrated a verified transmission from generation to generation. Reiser feels that if there is a definite hereditary factor in retinoblastoma, the number of families reported should certainly have exceeded this total. This in-

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† W. R. Parker Scholarship in Ophthalmology, Department of Ophthalmology, University of Michigan.

‡ Also reported by Carl V. Weller. The inheritance of retinoblastoma and its relationship to practical eugenics. Cancer Res., 1941, v. 1, no. 7, p. 517.

frequency of reported transmission of retinoblastoma is thus employed as a point against sterilization of all individuals afflicted with the malignancy.

The occurrence of retinoblastoma in several siblings of a family has been frequently reported in the literature. Newton[3] in 1902 observed a family of 16 siblings, 10 of whom displayed typical glioma of the retina (retinoblastoma). Brown[4] attended a family in 1891, of whom three members in a group of eight siblings had glioma of the retina. Lukens's[5] report is interesting in that first cousins manifest the neoplasm. Interesting familial case reports of the presence of retinoblastoma have been presented by many others.*

The occurrence of retinoblastoma in several generations of the same family has been rather infrequently reported. Transmission from an afflicted parent to the offspring was reported by S. A. Owens[21] who found unilateral retinoblastoma. DeGouvea[22] reported bilateral retinoblastoma in two females out of a family of seven siblings. Their father, at the age of two years, had been subjected to an enucleation of one eye for glioma of the retina. A. H. Griffith's[19] case, reported in 1917, is interesting in that the transmission is from the maternal side. Similar cases of transmission of retinoblastoma from parent to offspring have been reported by several authors.**

The "N" family first came to the attention of the Department of Ophthalmology on February 17, 1925, at which time two infant sisters were brought to the Clinic because of "eye trouble."

D. N., 18 months of age, presented bilateral retinoblastoma with definite orbital extension in the left eye. Exenteration of this eye was performed followed by X-ray therapy to the right eye. Four days postoperatively, at the time of the first dressing, recurrence of the neoplasm was present in the left eye and was so extensive that the tumor mass nearly filled the orbit. This patient succumbed six weeks later of intracranial extension and metastases.

B. N., two years old, presented retinoblastoma in the right eye. This eye was enucleated. However, pathological study revealed that the tumor had invaded the optic nerve and exenteration was performed. This child is now 18 years old, but is mentally retarded, of low-moron rating.

Sufficient interest was aroused by these two sisters' presenting retinoblastoma, to effect an investigation of their immediate family and its antecedents. The local Red Cross authorities were very gracious in their coöperation and investigated the family quite thoroughly.

Mr. N., a Polish laborer, to all outward appearances is a normal, healthy male of average intelligence. No history of present or past ocular pathology could be obtained. Mr. N.'s father died of gastric carcinoma at the age of 65 years. No other predecessor of Mr. N. could be recalled who had any ocular disease producing blindness or leading to death.

Mrs. N., also Polish, displays no present ocular pathology, nor does she recall ever experiencing any ocular difficulty. None of the ancestors of this woman, so far as could be ascertained, ever had any serious eye diseases. Mrs. N. is mentally deficient and classed as a low moron by the local health authorities.

A total of 10 siblings have been produced by these two individuals to date. Four of the 10 are apparently normal so far as freedom from the appearance of retinoblastoma is concerned. Four other children, besides the two previously men-

* See references 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20.

** See references 1, 2, 19, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35.

tioned, have been observed at the University Hospital because of retinoblastoma. They will be described in order of their appearance (fig. 1).

In 1930, E. N., a two-year-old female, was brought to the Hospital because of "blindness." A diagnosis of bilateral retinoblastoma was made. Enucleation was performed only of the left eye, since permission to operate bilaterally could not be obtained from the parent. During the postoperative convalescence the patient developed measles. By the time permission was obtained for further surgery, orbital extension in the right eye had occurred despite X-ray therapy. Exenteration of the right eye was performed, but the child died shortly thereafter. Autopsy findings disclosed diffuse extension of the retinoblastoma over the meninges, ependyma, and into the brain substance.

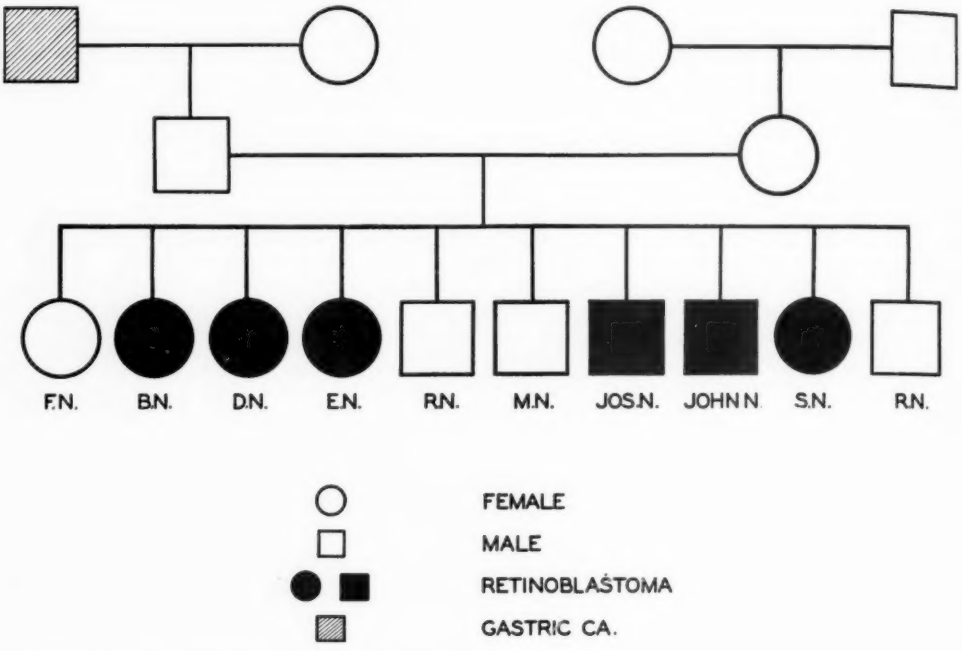

Chart 1 (Falls). Familial incidence of retinoblastoma.

1. F. N., aged 21 years; attractive, intelligent working girl; living.
2. B. N., aged 18 years; low moron; postoperative exenteration O.D. for retinoblastoma; living.
3. D. N., died, aged 10 months; bilateral retinoblastoma with intracranial extension.
4. E. N., died, aged two years; bilateral retinoblastoma with extension intracranially.
5. R. N., aged 15 years; moron intelligence; living.
6. M. N., normal boy of nine years; living.
7. Jos. N., died, aged three years, of bilateral retinoblastoma; local and intracranial metastases.
8. John N., died, aged four years, of unilateral retinoblastoma O.D.; extension along optic nerve.
9. S. N., living; aged 3 years; unilateral retinoblastoma; enucleated 1½ years of age.
10. R. N., living; one year old; normal fundi.

Jos. N., a four-year-old male, was seen in the Ophthalmological Clinic on February 4, 1937, presenting retinoblastoma of the right eye with perforation into the orbital tissues. An exenteration was performed on February 8th. The patient's immediate postoperative condition was quite satisfactory and the child was re-

turned to the care of the local County Health authorities. Recurrent orbital tumor in the right eye necessitated the return of the child on May 5, 1937. Exenteration of all soft tissue of the right orbit and suspicious bony tissue was repeated, but again recurrent growth appeared. X-ray therapy to the point of tolerance (6,000r unfiltered at 150 K. V.) was administered. Despite all therapy, the neoplastic growth continued to progress. The child was discharged with a hopeless prognosis. Death occurred on October 27th of the same year. Evident metastases to the face, to the cervical glands on the right side, to the right maxilla, and intracranially were reported by the local physician. No autopsy was performed.

A brother, one year of age, was examined at the same time, February 4, 1937. Bilateral retinoblastoma was diagnosed. The right eye was enucleated on February 16, 1937, since the parents had specified that surgery could be performed on only one eye. X-ray therapy of the left eye was initiated at once. Altogether 5,200, 7,400, and 3,000r were given to a medial, lateral, and pupillary port, respectively. Two hundred roentgen units were administered to each port every second or third day. No evidence of recurrence was observed until May 15, 1939, when the child was again seen because of ocular pain in the left eye. Ophthalmoscopic study revealed the globe of the left eye to be filled with neoplasm, and gross examination indicated the presence of intraorbital extension. An exenteration of this eye was immediately performed, but to no avail. The child died during the latter part of October, 1939. Metastases to the subcutaneous occipital region and bony occiput were noted by the local physician.

S. N., an 18-month-old female infant, was referred to the University Hospital on June 15, 1939, by the local ophthalmologist, with a diagnosis of retinoblastoma in the left eye. Funduscopic examination disclosed two large and distinctly separate neoplastic masses invading the vitreous space in this eye. An enucleation with glass-ball implant was performed on June 19, 1939. The pathological study of the excised globe did not present any evidence of local or optic-nerve extension of the neoplasm. The child's postoperative course was uneventful. To date repeated ophthalmological examinations have revealed no evidence of orbital recurrence in the left eye nor indication of a primary retinoblastoma in the right.

Cost of medical care

The cost of medical care for this family is of interest especially when considered from the standpoint of the drain on the local county-health budget. Up to the present time a total of $2,156.71 has been spent for hospitalization alone for this family. The expenses incurred for transportation and local medical care of the children can be conservatively estimated to amount to another $750.00. Gifts of clothing and surplus commodities granted by the local chapter of the American National Red Cross are not included in this total. It is thus recognized that a rather large sum has been spent, both in time and money, in the care of these afflicted individuals. The members of this family who have died have been a total debit to society, the time and money spent for their care now a complete loss. The siblings who have survived may unfortunately pass the neoplasm taint on to their offspring, and thus a greater burden may fall upon society.

Early sterilization of the mother, preferably at the time when the family was first observed, would have alleviated a great deal of suffering, unhappiness, and expense. Many attempts have been made

to effect this procedure, but religious and personal principles have been insurmountable barriers. In view of the frequency of the occurrence of retinoblastoma it is indeed regrettable that this woman should be permitted to continue to produce children.

Comments

Our present source of knowledge of the inheritance of retinoblastoma is limited, and one is not permitted to urge that all afflicted individuals be sterilized. In respect to the surviving afflicted individuals of the "N" family one can only say that the possibility of their children displaying retinoblastoma is low; nevertheless, the factor of inheritance should be uppermost in their minds when considering marriage, and, if children do appear, the occurrence of one with retinoblastoma should be the indication for practicing strict and careful birth control if not sterilization. It is indeed deplorable that state and county health funds should have to assume the burden of providing for such families, when the greater proportion of the tragedy could be averted through sterilization of the parents.

Summary

The "N" family is reported because of the rather unusual tendency toward the appearance of retinoblastoma among the siblings. Six, out of a total of 10 siblings, have manifested the neoplasm to date. Two children, both presenting monocular retinoblastoma, have survived surgical treatment. Of the four deceased members, three displayed bilateral involvement.

Conclusion

1. Sterilization is strongly urged in parents who have produced two children exhibiting retinoblastoma.

2. The appearance of one child displaying retinoblastoma among siblings of parents who have had the neoplasm, or in a family in which retinoblastoma has frequently appeared, should be the indication for taking steps to prevent further offspring.

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CONJUNCTIVOCHALASIS

WENDELL L. HUGHES, M.D., F.A.C.S.
Hempstead, New York

The condition of laxity of the lower bulbar conjunctiva, sufficient to cause symptoms, was first brought to my attention in 1933 when I recognized this condition as an entity. Since that time many cases have been seen.

The purpose of this paper is to bring this condition to the attention of the profession, describe a permanently satisfactory treatment, and to suggest a name, conjunctivochalasis, from the Greek word meaning relaxation. The word, blepharochalasis, is also derived from the Greek, designating a condition of excessive laxity of the skin of the lid.

Reports of cases of this condition are exceedingly rare. It is not described in any of the textbooks which I have consulted.

In conjunctivochalasis the bulbar conjunctiva on the lower part of the eyeball is very thin and much more movable on the eye than is the case normally. Sometimes the fold in the conjunctiva may be seen spontaneously, without the application of any external pressure, by merely having the patient look up and then down, several times. It may be necessary, at the same time, to put some tension on the lower lid at the lateral canthus in order to produce the fold. By means of slight external pressure from below upwards in the middle of the lower lid, the conjunctiva can be pushed up to produce an actual fold at the lower limbus and over the cornea, sometimes for a distance of one to three millimeters (fig. 1, A, B). Occasionally there is some irritation and the congestion of recurrent hemorrhages as well as intermittent, sharp pain due to the conjunctiva's becoming squeezed between the lid and the lower corneal margin.

The signs and symptoms are:

1. Pain, due to the compression of the fold of conjunctiva usually at the lower limbus or where it folds on itself. The pain, which may be mild or severe, is often sudden and "stabbing" and occurs on looking down. It is sometimes described as being like a foreign body.

2. There is often irritation of the conjunctiva and cornea, usually at the lower limbus; a small marginal ulcer may be present due to the irritation and traumatism.

3. Repeated subconjunctival hemorrhages. These are due to the twisting of blood vessels either by movements of the eye and lids or by the patient's rubbing of the eye. It was present in only one of my series of cases.

ETIOLOGY

The cause is unknown but it is apparently one of the senile changes that occur in the conjunctiva. The age in one case was 49 years while in all the others it was 65 or over. It has been noted that there is usually laxity of the skin in general, particularly that of the face and eyelids, suggesting an involvement of the subcutaneous, elastic, or supporting tissue of the superficial fascia elsewhere, as well as in the conjunctiva.

TREATMENT

The excess conjunctiva was removed in four cases in which the symptoms were severe enough to warrant excision. A crescentic strip of bulbar conjunctiva, 2.5 cm. long by 0.5 to 1 cm. wide at its widest, was excised from the lower portion of the eyeball and the surrounding conjunctiva undermined up to the limbus and down to the fornix (fig. 1, C).

The amount of conjunctiva excised would, of course, differ in individual cases. The incision was closed with a fine continuous black-silk suture (fig. 1, D). In this manner the excess conjunctiva was removed and the remaining tissue became adherent to the underlying fascia bulbar conjunctiva in loose folds with blood vessels following the irregularities of contour. With movements of the lids the folds were compressed and squeezed, so that a break in the vessel wall could very easily be induced. Otherwise the ocular findings were irrelevant. Vision was 20/20 with each eye, the error of refraction +0.75 D.sph. in each eye; corneae, media, and fundi were normal. The right eye was normal

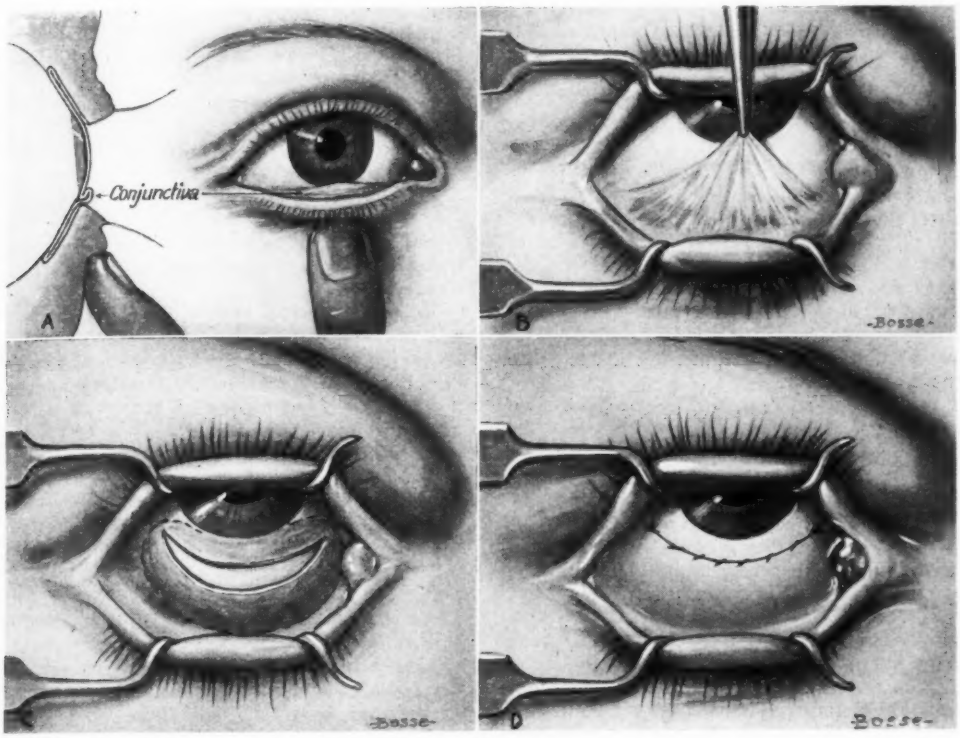

Fig. 1 (Hughes). Conjunctivochalasis and the surgical steps in its removal. A, front view and cross section, showing fold of conjunctiva pushed up over the lower limbus. B, lax conjunctiva on the lower part of the eyeball picked up with a forceps. C, Crescentic section of conjunctiva removed with undermining of the surrounding area. D, closure of conjunctival incision with continuous suture locked at each end.

and sclera, thus preventing a recurrence of the condition.

Case reports

Case 1. Mr. L. R., aged 49 years, presented himself in March, 1933, with a subconjunctival hemorrhage in the lower temporal portion of the bulbar conjunctiva of the left eye. Past history revealed that he had had a similar condition every three to four months for the past four years.

Examination of the eye revealed a very lax in all respects. The patient was told to return in 12 days for operation.

By March 20, 1933, the hemorrhage had been absorbed, but the conjunctiva was still quite lax and thrown into folds.

Under local anesthesia the procedure aforedescribed was carried out and a dressing applied and left in place for four days; then the suture was removed, and a mild astringent drop instilled for another 10 days. Subsequently the patient has been seen at intervals of about two years for estimation of his refractive error (1935, 1937, 1940). There has been no return of the condition.

Case 2. Mrs. T. J. D., aged 65 years, was seen on September 16, 1940, with an irritation of the right eye that had been present for three days. She was seen by her family physician who referred her to me for advice. He thought she had scratched her eye.

The vision was 20/25 with each eye with the glasses then in use. The refractive error checked at a later date revealed only a small change, which was irrelevant.

Examination showed a fold of conjunctiva as previously described, which encroached on the cornea and was pinched by the edge of the lower lid, especially when the patient moved her eye downward.

The described surgical procedure was carried out.

The wound healed in a few days and the patient has had no discomfort with this eye since. She had a small fold in a similar location on the other eye but had very little discomfort from it, so no surgical treatment was advised at that time. Later, however, the eye that had been operated on felt so comfortable that she returned for surgery of the second eye. This was carried out about six weeks after the operation on the first eye.

Case 3. Mr. B. T., aged 72 years, complained of having had "sore eyes" for many years. The vision had been failing of late: R.E., ability to detect hand movements; L.E., 20/70 (1936). Several operations had been performed on the lids by his attending surgeon in 1936, 1937, 1938, as follows: November 14, 1936, Kuhnt-Szymanowski, right eye; December 19, 1936, plastic repair, right eye; December 26, 1936, plastic repair, left eye; November 20, 1937, plastic repair, right eye; March 12, 1938, tarsal resection; August 3, 1939, Zeigler cautery, both eyes.

This patient was seen in consultation, January 27, 1940, at which time a 3-mm. fold of conjunctiva was seen encroaching on the cornea of the right eye below; in this area a marginal ulcer was also present.

A diagnosis of pemphigus had been suggested and a phyto-toxic index of 58 was found. The blood sugar was 164 mg. per 100 c.c. Culture from the conjunctiva showed toxic and hemolytic Staphylococcus aureus. X-ray studies of the jaws and sinuses showed no pathology. Excision of the fold with undermining of surrounding conjunctiva was advised and carried out on February 10, 1940, by the attending surgeon.

The entropion, of course, persisted, and two other operations were subsequently performed for its correction. The patient was last seen on January 7, 1941.

Case 4. Mrs. A. E. L., aged 80 years, presented herself on October 1, 1940, with a marginal ulcer at the lower portion of the cornea of the left eye. She gave a history of having had occasional sharp twinges of pain in both eyes with some irritation on reading or looking down, during the past two years.

Inspection of the eyes revealed a very loose bulbar conjunctiva on the lower part of both eyes, more marked on the left eye. It could be moved about extensively on the underlying sclera by means of a cotton-wound applicator soaked with pontocaine.

In the left eye there was considerable congestion near the limbus below and a marginal ulcer about 4 mm. long. On microscopic examination several areas of superficial infiltration could be seen in the corneal epithelium along the nearby limbus.

The ulcer was treated by the application of a 0.5-percent silver-nitrate solution to the palpebral conjunctiva, and argyrol and hot compresses were prescribed for use at home.

On October 4, 1940, there was still considerable irritation and redness. The ulcer was still active although somewhat smaller. A week later the ulcer was still active and the eye irritable.

When the patient looked down the conjunctiva was pushed up over the limbus in the area of the ulcer and this was thought to be a factor in the continuation of the ulceration and irritation of the eye. The aforementioned surgical procedure was performed under novocaine-infiltration anesthesia. The suture was removed in four days. The patient has been seen at intervals since the operation. The ulcer healed quickly and the eye has been quite comfortable since. The bulbar conjunctiva of the other eye had a slight tendency to fold over the limbus at the lower part which caused only minor discomfort, insufficient to warrant any surgical interference.

Case 5. Mrs. M. S., aged 77 years, on December 2, 1939, complained of burning and itching of the eyes of six to eight months' duration, and discomfort on prolonged reading. One brother and one sister had glaucoma.

The vision with correcting lesense was 20/70 in each eye. At 220 mm., 1.04-mm. type could be read with the right eye and 0.7-mm. type with the left. The intraocular tension was normal, but there were incipient cataractous changes which accounted for the loss of vision. On October 15, 1940, the patient was still having discomfort, burning, aching, and pain in the left eye. The conjunctiva covering the lower part of the eyeball was quite lax and by pressure below it was easily pushed into a fold over the lower limbus.

A crescentic piece of conjunctiva was removed, with relief of symptoms.

Discussion

The condition herein described is not uncommon, but judging by the scarcity

of reports in the literature and its absence from textbooks, it remains generally unrecognized.

Symptoms arise from the traumatism to the conjunctiva and its nerves and blood vessels and the adjacent cornea. A mechanical irritation is set up by reason of its being pushed up by the sharp tarsal margin of the lower lid. A fold is thus formed as the conjunctiva rolls up over the lower edge of the cornea.

The treatment is simple and permanently effective. Heat or chemical cauterization might be equally effective, although it would seem that surgical removal of a piece of conjunctiva with the undermining of the surrounding conjunctiva would give a more certain and satisfactory result. The results of this procedure have been very satisfactory in each instance.

Specimens of conjunctiva were removed from two patients and were examined by Drs. A. B. Reese, Bernard Samuels, and Brittain F. Payne. The specimens were stained with hematoxylin and eosin, and Weigert's elastic-tissue stain. No pathological changes were recognized microscopically. No fragmentation or other abnormality of the elastic tissue fibers was present.

Braunschweig, in Germany (1921), was the first to describe the condition. He presented four cases, in three of which he operated with satisfactory results. The only pathological report has been offered by Denti in Italy (1930), which reads as follows:

> Epithelium was normal. Elastic stratum, stained with Weigert's stain, showed alterations consisting of variations in the thickness of the elastic fascia directly in the epithelium, it being in most places one half the normal thickness. There were interruptions of continuity with foci which (on carmine staining) stand out from the dark-violet elastic tissue. Under high magnification the elastic tissue showed swelling, fragmentation, irregular course of the fibers, which appeared tortuous and in some places were quite coarse and in other places reduced to granular tissue. No evidence of inflammation. The blood vessels were normal and the elastic tissue of the media was normal.

Denti did not consider the process to be identical with blepharochalasis, since there is no evidence of inflammation and swelling of the parts and no formation of new blood vessels. There is also a difference in the age incidence, he said, blepharochalasis occurring between puberty and the age of 25 years, while the present condition appeared most frequently during the fifth decade. The age in his case was 50 years.

The pathology of this condition should be confirmed by studies of further specimens.

131 Fulton Avenue.

OPHTHALMIA NEONATORUM*

The etiology in 62 consecutive cases

S. Hanford McKee, M.D.
Montreal, Canada

Over a period of some years, 62 cases of ophthalmia neonatorum have come under observation. Nearly all of the patients were sent into the infant's ward of the Children's Memorial Hospital from the poorer districts of Montreal, where, unfortunately, midwives are still allowed to perform obstetrical duties. Information as to whether the Credé method of prophylaxis had been used or not was often unobtainable. I am told that many of the midwives use lemon juice as a prophylactic instead of 2-percent silver nitrate.

The first microörganism described as the cause of ophthalmia neonatorum was the gonococcus. Shortly after its discovery by Neisser in 1879,[1] in cases of urethritis, numerous investigators found the same microörganism in cases of ophthalmia of the newborn. With improved methods, such as the use of Gram's staining method, it was soon found that other microörganisms than the gonococcus were concerned as the cause of this disease. In this connection there have been described the pneumococcus, the so-called Koch-Weeks bacillus, Staphylococcus aureus, Streptococcus pyogenes, the diplobacillus of Morax Axenfeld, Bacillus coli communis, Bacillus influenzae, and others such as the Bacillus diphtheriae in the pseudomembranous form.

In a recent study Thygeson[2] reviewed the etiology in 261 institutional cases of conjunctivitis of the newborn. He found 51.7 percent due to the Staphylococcus aureus, 13 percent to the pneumococcus, 8.8 percent the virus of inclusion blennorrhea, and only 1 percent to the gonococcus. These figures testify to the efficiency of the Credé method of prophylaxis against the gonococcus, used in all of these cases.

Quite different were the figures in a previous report of the writer where in a series of ophthalmia-neonatorum cases the following etiology was established.

	Cases
Gonococcus	43
Streptococcus pyogenes	6
Pneumococcus	8
Staphylococcus aureus	5
Micrococcus catarrhalis	2
Diplobacillus of Morax Axenfeld	2
Bacillus coli communis	1
Epithelial-cell inclusions	6
Negative	1

In spite of the diligent search usually made for a bacteriologic cause of this form of ophthalmia, one finds, in almost all statistics on this subject, that there were numerous cases in which no bacteria could be demonstrated, either by smear or culture. Opinions as to the reason for this have varied considerably. Some have felt that in these so-called negative cases gonococci were present, but too few in number to be demonstrated. Probably laxity in the preparation of the smear and examination of the slide accounted for negative results in some of the cases. Recently, it has been established that there is a very definite form of ophthalmia neonatorum in which microörganisms are not found. The so-called inclusion blennorrhea. In 1903, Morax described nonbacterial cases under the heading of "conjunctivite amicrobi-

* From the Department of Ophthalmology of the Children's Memorial Hospital, Montreal.

enne." He believed that these cases were caused by a pathogenic agent that had not as yet been discovered. Probably many of these cases were due to the virus of inclusion blennorrhea. In 1906, in an article by R. Augé, Morax[3] gave the remarkable statistical record that among 165 cases of ophthalmia neonatorum, 70 were gonorrheal, 95 were non-gonorrheal, and of this latter no fewer than 77 were "amicrobienne."

In a recent series of 62 cases in Montreal, the following etiology was established:

	Cases
Gonococcus	12
Pneumococcus	3
Pneumococcus or streptococcus	5
Epithelial-cell inclusions	25
Epithelial-cell inclusions and gonococci	15
Incusions and pneumococcus	1
Inclusions and streptococcus	1

It will be noted that in these 62 cases, no less than 42 were found with inclusions. In 25 cases, the inclusions were found alone, while in 17 others there was present a mixed infection of inclusion virus and microörganisms. In 15 of the latter, the mixed infection was due to the gonococcus. For practical clinical purposes, it is important to remember, as this list well demonstrates, that the gonococcus is the common cause of ophthalmia in the newborn, and as it is one of the most destructive agents met with in the inflamed eye, any case of ophthalmia neonatorum should be considered due to the gonococcus and treated as such until it has been shown to be caused by some other agent.

The cases due to microörganisms differed in no special way from the stock pattern. Some were more severe than others, but generally the course run was the usual one. One eye was lost. Baby G. when admitted had a perforated ulcer of one cornea, and oddly enough the infection in this severe case was due to a pneumococcus. It was typed, but at that time typing extended only to numbers I, II, and III, and group IV. The pneumococcus was placed in group IV. One of the other pneumococcus cases which also ran a severe course was found to belong to type III.

Rather striking has been the coincident infection of inclusion blennorrhea and the gonococcus. In these mixed cases the course of the infection was very similar to that in ordinary gonorrheal ophthalmia, except a tardiness in clearing up completely. However, since sulphanilamide has been administered in these cases, this feature is completely changed and they now clear up rapidly (fig. 1, A, B).

Secretion smears and epithelial-cell scrapings were made from each case. A number of slides were always made, one being first stained by Gram's method, and one with Giesma stain for diagnostic purposes. Where possible, cultures were made with either chocolate-agar plates, blood-agar, hydrocele, or ascetic-agar slants. These were incubated at 37°C. and examined after 24 to 48 hours. As a rule the diagnosis was made from the smear preparation. If the pus was found to contain numerous gram-negative intracellular coffee-bean-shaped diplococci, the case was considered to be gonorrheal. The laboratory diagnosis of inclusion blennorrhea was made from the Giemsa-stained epithelial-cell preparations, with the finding of the basophilic heterogeneous inclusion bodies, characteristic of the disease. In the acute stage, inclusion diagnosis can also be made from secretion smears by the finding of free elementary bodies. If the specimen is kept free of dust and carefully decolorized, the elementary bodies will be readily differentiated from neutrophilic granules or nonspecific granules of any sort. Here, as in using Gram's method, reliable re-

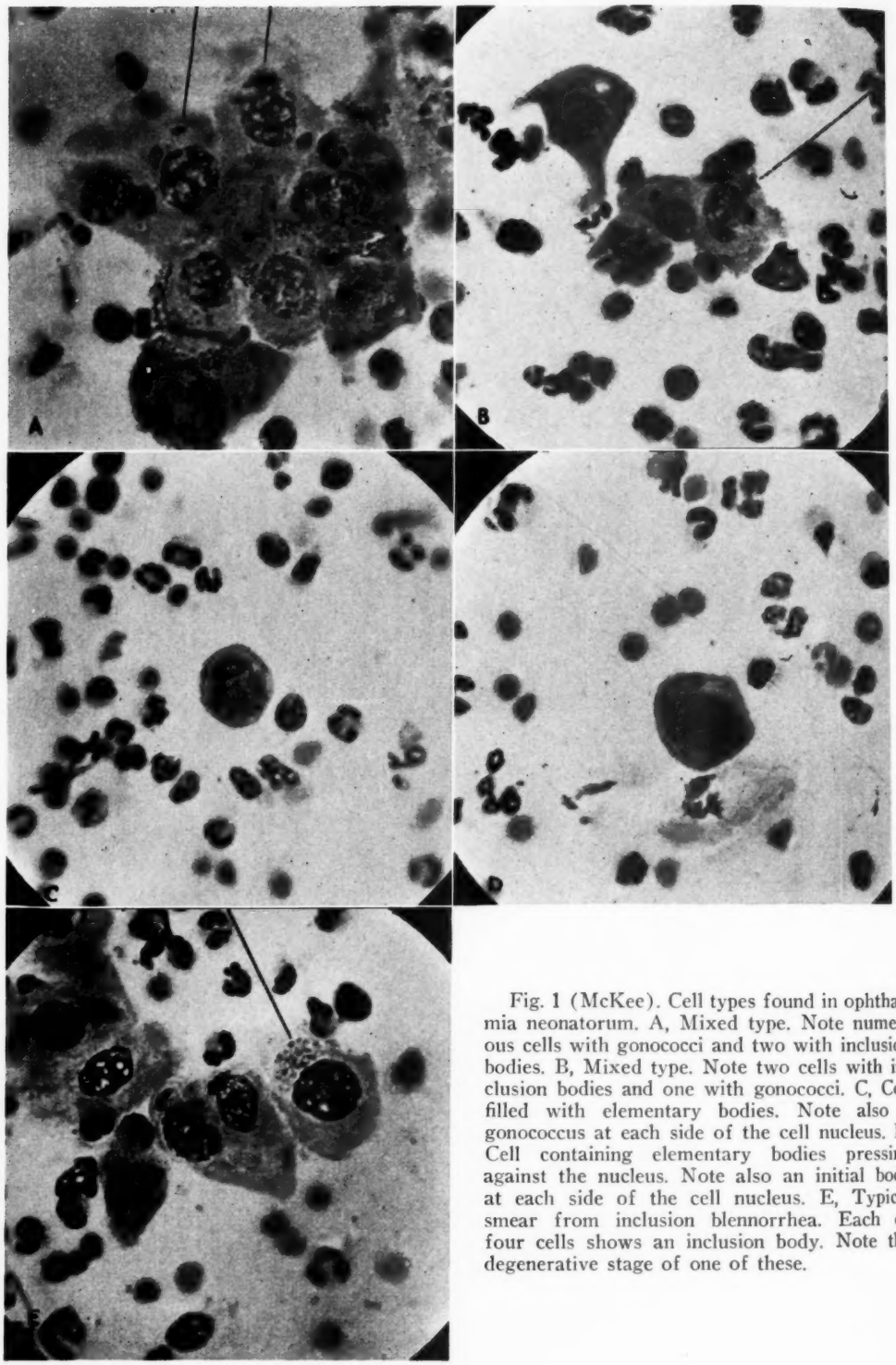

Fig. 1 (McKee). Cell types found in ophthalmia neonatorum. A, Mixed type. Note numerous cells with gonococci and two with inclusion bodies. B, Mixed type. Note two cells with inclusion bodies and one with gonococci. C, Cell filled with elementary bodies. Note also a gonococcus at each side of the cell nucleus. D, Cell containing elementary bodies pressing against the nucleus. Note also an initial body at each side of the cell nucleus. E, Typical smear from inclusion blennorrhea. Each of four cells shows an inclusion body. Note the degenerative stage of one of these.

sults will be obtained only if the preparation of the smear and the staining of it are carried out in a careful and regular manner.

The problem of diagnosis in ophthalmia-neonatorum cases is simplified by the fact that normally only the C. xerosis, C. hofmanni, and the odd staphylococcus —generally the epidermidis albus—are present in the conjunctival sac.

To get a satisfactory epithelial-cell smear, one should proceed as follows: A drop or two of 4-percent cocaine solution is instilled into the conjunctival sac, and after a minute or two the palpebral conjunctival surface is gently stroked with a small blunt curette. If this is done carefully, sufficient material will be obtained without any bleeding, and this is to be desired. The material is then gently spread over a clean slide, free of dust, and is allowed to dry and then fixed by immersing in chemically pure (acetone-free) methyl alcohol for two hours or even longer. The dry slide is then transfixed to diluted Giemsa solution (1 drop to 2 c.c. of neutral distilled water or to 1 drop of Giemsa stain add 19 drops of distilled water, and allow to stain for one hour or longer). The stained slide is then decolorized for five seconds in each of two changes of 95-percent ethyl alcohol. Dry in the air, and examine with the oil-immersion lens. This method gives a very satisfactory differentiation between cell protoplasm, elementary bodies, initial bodies, and cell inclusions.

Differentiation of the pneumococcus and streptococcus was made by the morphology on smears and by the cultural characteristics. In some cases, the differentiation between these two was not completed, due to one cause or another. In most conjunctival cases, the pneumococci are very typically lanceolated, while the streptococci are seen to be round, with flattened opposing edges.

Inclusion blennorrhea is a distinct clinical entity of a varying degree of severity, characterized by a definite incubation period, and by the presence of cytoplasmic inclusion bodies in some of the conjunctival epithelial cells. It is transferable to the human adult conjunctiva and produces a conjunctivitis identical with swimming-pool conjunctivitis, in which also the inclusion bodies are found. The inclusion bodies are met with in different forms, probably constituting intracellular virus colonies in various stages of development. The virus is filterable, and this has been confirmed by a number of investigators.

No sooner had Halberstaedter and Prowazek[4] reported their findings of epithelial-cell inclusions in cases of trachoma, than evidence casting doubt on the specificity of these bodies for trachoma appeared. In an infant with blennorrhea free of gonococci, Stargardt[5] found what he took to be the same inclusion bodies that had been found in trachoma. Heymann,[6] in four cases clinically and culturally gonorrheal blennorrhea of the newborn, found similar inclusions in great numbers. He also reported the presence of inclusions in the urethral and cervical mucosa, respectively, of the parents of the children with ophthalmia neonatorum.

Halberstaedter and Prowazek, following Heymann's report, made similar examinations with regard to infantile ophthalmia. They concluded that there was a large group of nongonorrheal ophthalmia characterized by the presence of chlamydozoa in which the infection took place *intra partum*, which they looked upon as a special infectious disease—"chlamydozoa blennorrhoea." They too found bodies in the genito-urinary tract of some of the mothers, and also in the urethra of males suffering from a nongonorrheal inflammation. In a former report they

stated that they believed the chlamydozoa of ophthalmia to be morphologically identical with those of trachoma, but that the two might be differentiated biologically. Later, Flemming,[7] among 32 cases of infantile conjunctivitis, found inclusion bodies in 12. In 1910, I[8] reported the presence of trachoma bodies in the normal conjunctiva. Two cases were brought for examination at the Maternity Hospital and looked clinically normal. Smears were prepared and were found to contain inclusions identical with those described as characteristic of trachoma. The inclusions were numerous. In the light of many similar cases seen since then it is now believed that these were mild inclusion conjunctivitis cases. In 1911, I[9] reported on a number of infants with acute purulent conjunctivitis in whom inclusions were found in great numbers. In 1925, Lindner[10] developed a theory that inclusion blennorrhea was a para-trachoma, corresponding to paratyphoid in relation to typhoid, but that it had been modified to assume different and attenuated characteristics in its habitat in the genital tract. He confirmed the presence of inclusion bodies and free elementary and initial bodies in material from the genito-urinary tract of mothers of babies with inclusion blennorrhea. In 1930, James[11] reported four cases of inclusion blennorrhea in 2,446 deliveries at the Saint Louis Maternity Hospital. Lumbroso[12] published reports in 1933 and 1934 in which he concluded that inclusion blennorrhea was a specific conjunctival disease almost always distinguishable from gonoblennorrhea. In 1934, Thygeson[13] published a most illuminating article on the etiology of this condition. He concluded that inclusion blennorrhea was a distinct clinical entity with definite characteristic features caused by a filterable virus. In 1936, Thygeson and Mengert[14] reported further on the virus of inclusion conjunctivitis. In recent years considerable attention has been given to the question of the rickettsial nature of the inclusions of trachoma and inclusion blennorrhea. According to Hamburger,[15] Kroner in 1884 had suggested that blennorrhea of the newborn, in which the gonococcus is not present, was caused by an unknown agent, the primary seat of which was in the birth canal of the mother.

Inclusion blennorrhea generally begins acutely from the fifth to the ninth day after birth, and may be characterized by severe conjunctival inflammation with edema and infiltration, which is especially marked in the fornices and in the lower lid. A severe early infiltration of the conjunctiva of the lower lid is a very characteristic sign of the severe form. Involvement of the preauricular gland is quite common. The acute stage, before the introduction of sulfanilamide, lasted about two to three weeks and was followed by a chronic one of some weeks' or months' duration. With the new chemotherapy, the prognosis is excellent and a return to normal conditions may be expected in all cases in a matter of 10 days, or so. Where the infection is mixed with gonorrhea, there is no great difference in the course from that of the ordinary gonorrheal ophthalmia neonatorum.

Because of the constancy with which inclusion bodies, both intracellular and free, are found in this form of conjunctivitis, their presence and meaning has for years aroused great interest. Halberstaedter and Prowazek in their original description of the inclusion bodies of trachoma, described them as being made up of a bluish-staining ground substance or matrix, which they called "plastin," and a mass of fine, distinct, reddish granules, which they termed "elementary bodies." They regarded the latter as the active agent of the disease. Lindner con-

tested this interpretation of the blue substance on the matrix, and demonstrated that what appeared an amorphous material in the dry fixed preparations was actually a compact mass of well-defined, relatively large, granular bodies. He studied these outside the cell, and demonstrated division forms and forms showing transition to the smaller elementary bodies. He called them "initial bodies." It is of interest to note that this type of morphologic variation of the component bodies of cytoplasmic inclusions has been recognized also in psittacosis, a virus disease. The initial bodies, then, of inclusion conjunctivitis are composed of a matrix in which are found elementary and initial bodies (fig. 1, C).

The elementary bodies are of uniform size—about 0.25 mu in diameter. With Giemsa stain they occur as very small reddish cocci embedded in a blue-stained matrix. They resemble in size and staining reaction the elementary bodies found in vaccinia, fowlpox, and psittacosis. Phagocytosis of the elementary bodies by leucocytes is frequently seen. The elementary bodies are probably the typical form of the organism.

The initial bodies are cocco-bacillary in shape, and vary from 0.3 to 0.8 mu in their greatest diameter. They are also Gram negative and stain poorly with aniline dyes. With Giemsa stain they are a blue color and often seen bipolarly. Division forms are frequent. They are identical in morphology and staining reaction with the initial bodies of trachoma (fig. 1, D).

Considerable difference of opinion has arisen regarding the interpretation of just what these parts of the inclusion body mean. It is now believed by most workers that the initial body is the swollen form of the elementary body in its first three or four intracellular divisions. The morphological difference between the elementary and initial body would then seem to be the normal difference between young and old forms. The virus of psittacosis has exactly the same type of morphologic variation. The evolution of the inclusion body of inclusion blennorrhea may be described as a "developmental cycle." This was the term used by Bedson and Bland[16] to describe the change in the appearance of the psittacosis bodies.

The viral etiology of inclusion conjunctivitis seems to have been established in as much as the inclusion bodies found in this inflammation are similar to those found in psittacosis and are of the same nature as those found in vaccinia, variola, and other recognized virus diseases. It arises by way of the genital tract of the mother, in whom the infection is, strictly speaking, venereal in origin. Typical inclusions from the vagina and cervix of the mothers of infants with inclusion blennorrhea have been frequently demonstrated, though the maternal condition is gynecologically trivial.

The infectivity of bacteria-free filtrates has been shown to be dependent on the presence of the elementary bodies. That inclusion blennorrhea is of viral etiology has been established by the filtration experiments of Gebb, Botteri, Thygeson, Tilden and Gifford, and others. There can be little doubt that the inclusion is an actual phase of the infection. The heterogeneous structure of the inclusions suggests that the inclusion is not due to a degenerative change. Probably it is the diversity of the views regarding the makeup of the inclusion body that makes its study so attractive. Whatever their nature, there is no gainsaying their frequency in inclusion conjunctivitis. Also a fact of great importance is their presence both in animals and man when infected with filtered material (fig. 1, E).

Originally, the patients in these cases were all treated with the usual Children's

Hospital routine of constant irrigations with warm bland solutions, 40-percent argyrol, foreign protein, and compresses hot or cold as indicated. Latterly, in addition to the aforementioned local treatment, all the patients received sulfanilamide by mouth, given with bicarbonate of soda in the dosage of 1 gr. per pound of body weight in the 24 hours, for three days. This was followed by 3-days' treatment with one half the dosage. In all the cases the results were most striking, well illustrated by the last case treated.

A baby, premature seven months, which weighed 3 pounds, sent into the Hospital on the seventh day of life, was found to have a double ophthalmia, due to gonococcus and inclusion virus, a mixed infection. The ophthalmia was quite severe, there was considerable discharge, and there were large numbers of gram-negative diplococci of characteristic shape present in the cells and free. In addition, in the Giemsa-stained epithelial-cell preparation numerous basophilic heterogeneous inclusion bodies were found. As the baby weighed 3 pounds, it was given 3 gr. of sulfanilamide with soda in the 24 hours for 3 days, at the end of which time the condition had so improved that its eyes were well opened, and the discharge had practically ceased. No gonococcus nor inclusions could be found in prepared slides. The baby now received 1½ gr. for three days, when it was declared well, and two or three days later was discharged from the Hospital.

Comment

In 62 cases of ophthalmia neonatorum, no less than 42 were found with cytoplastic inclusion bodies in some of the epithelial cells. This demonstrates how prevalent the inclusion type of blennorrhea is in this area. Rötth claimed that inclusions are present in most of the infantile blennorrheas, and that in Hungary there is one case of inclusion blennorrhea in every 500 eye cases.

In 25 cases, inclusions were found alone. In these cases a considerable variation in the severity of the inflammation was noted.

In 15 cases, the infection was a mixed one of inclusions and gonococci, and in 2 of inclusions and pneumococci or streptococci.

In eight of the cases, the infection was due to either the pneumococcus or streptococcus.

In the 62 cases, one eye was lost. This baby entered the Hospital with a perforated cornea. The infection was found to be due to a pneumococcus. This was typed and placed in group IV. One other pneumococcus case, in which typing was obtained, proved to belong to group III.

Judging from this series, inclusion blennorrhea forms a large part of the ophthalmias of the newborn. While previously the treatment was simply symptomatic with consequent slow progress, the addition of sulfanilamide by mouth, which has proved so beneficial in another virus disease, trachoma, has proved equally beneficial in the treatment of inclusion blennorrhea. Sulfanilamide was found to be equally efficacious in gonococcal ophthalmia, and in the mixed cases.

1528 Crescent Street.

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SULFATHIAZOLE IN THE TREATMENT OF GONORRHEAL EYE DISEASE*

CARROLL R. MULLEN, M.D.
Philadelphia

Sulfathiazole has been used successfully in the treatment of gonorrheal disease of the human eye at the Philadelphia General Hospital. This drug is the thiazole analogue of sulfapyridine and is prescribed extensively in the treatment of pneumonia, staphylococcal infections, and in gonorrheal infections of the urologic tract. Because of favorable results, together with its reported low toxicity, uniform absorption, and little or no tendency to provoke nausea or vomiting, it was felt that its use was justified in the treatment of diseases of the eye caused by the invasion of gonococci.

For more than three years previous to the use of sulfathiazole, gonorrheal infections of the human eye have been treated with increasing success at the Philadelphia General Hospital. Results of these observations were reported by this essayist before a meeting of the Pennsylvania State Medical Society in 1940.†

The pharmacology and chemotherapeutic action of this drug have been presented and discussed so frequently in the medical literature that is not necessary to repeat it in this paper.

Physicians have had sufficient experiences with this drug to create cautions in its use. These include delayed toxic effects, drug rashes, renal and bladder concretions, and severe toxic effects, such as agranulocytosis or neutropenia and acute hemolytic anemia. None of these phenomena were observed in the treatment of this disease at the Philadelphia General Hospital, probably because the drug was used for such short periods of time with each patient. However, blood studies, which included red and white cell counts, hemoglobin and sulfathiazole levels, were made in order to recognize early changes that might be occurring from its use. No unfavorable blood pictures were reported, and in no case was it necessary to interrupt treatment before conclusion.

A total of five cases from the ophthalmological services of Drs. T. A. O'Brien, Alfred Cowan, and Carroll R. Mullen at the Philadelphia General Hospital were treated with the use of this drug. The technique of treatment was closely aligned with that of sulfanilamide, which was

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* Read before the College of Physicians of Philadelphia, Section on Ophthalmology, February 20, 1941.

† "Three years clinical experience in the treatment of gonorrheal disease of the eye with sulfanilamide," Section on Diseases of the Eye, Ear, Nose, and Throat, Pennsylvania State Medical Society meeting, Philadelphia, October 1, 1940.

mentioned above. The drug was administered in an average dosage of 1 gr. daily per pound of body weight for each child or adult up to 100 grs. daily. In older children and adults the dosage was graduated according to clinical needs.

The internal administration of the drug started immediately upon admission to the Hospital. In many cases it was decreased after 24 hours. A solution of 0.2-percent sulfathiazole was prepared from the powdered drug, and this was instilled after irrigation of each involved eye at 10-minute intervals for the first 24 hours. This procedure did not permit interruptions by sleep or feedings. The routine use of a solution of atropine and iced compresses, together with a Bullar shield when indicated, was also followed out.

The value of the nursing care of these cases cannot be underestimated. It has been our experience that nurses working in pairs on eight-hour shifts for the first 24 hours best serve to accomplish the needs of this frequent and prolonged type of treatment.

In all cases smears which diagnosed the infection were read in the laboratory of the Philadelphia General Hospital. Daily smears were subsequently taken. No patient was discharged or considered cured until there were reported three successive negative smears and the absence of clinical evidence of gonorrheal infection.

Five patients were treated with this drug and there were no ocular complications. The longest period of treatment was over parts of three days before the first of three successive negative smears was obtained. The usual case showed negative results at the conclusion of the first 24 to 40 hours of treatment. Corneal complications were not found in any case. One patient returned several months after treatment was concluded, and a slitlamp examination showed no involvement nor complications in the cornea of the involved eye.

No toxic effects were noted. No difficulty was encountered in taking the drug internally. This was administered to a child by pulverizing in water and feeding through the nipple of a feeding bottle.

Case reports

Case 1. M. W., a white female, aged 22 years, was admitted on the night of June 11, 1940, and discharged on June 15, 1940, following three successive negative smears. The onset in this case occurred two days before admission. Some local treatment and a small amount of sulfanilamide were taken during that period. On admission the upper and lower eyelids of the right eye were swollen and chemotic as were the palpebral and bulbar conjunctivae. The cornea was slightly hazed, but there were no areas of staining. Treatment with sulfathiazole and sodium bicarbonate in 15-gr. doses of each every four hours was continued for 2½ days. A solution of sulfathiazole 0.2-percent by local instillation was started immediately. Atropine solution of 1-percent strength was instilled in the involved eye and iced compresses were used at frequent intervals. There was no alteration in either of two blood counts. The first of three negative smears was obtained 40 hours after treatment was started. The patient was discharged as cured. She was reëxamined on November 7, 1940, almost four months after the onset, and no corneal involvement nor complications were noted. The vision in this involved eye was 6/6 plus three, while that in the uninvolved left eye was 6/6.

Case 2. W. G., a white male, aged 21 months, was admitted on July 12, 1940, and discharged after three negative smears on July 17, 1940. This child was probably infected through an older brother, aged eight, who had been admitted to this Hospital with genital involvement a short time before. Two days before admission the right eye became involved and red. Argyrol was used by a local physician. The ocular findings were typically those seen in gonorrheal eyes on admission, but there was no corneal involvement. Sulfathiazole, to be used internally in doses of 2 gr. every four hours was prescribed for three days. Irrigations with a solution of sulfathiazole every 10 minutes was continued for 24 hours. The interval between irrigations was then lengthened. A blood count on admission showed a small amount of red-blood-cell anemia. The first negative smear in the right eye was obtained two days after admission. Subsequently there were three negative smears and the child was discharged without ocular complications.

Case 3. L. H., a newborn male infant, was sent to the Eye Department four days after birth. The baby's eyes were first noticed to be inflamed on the previous night; the following morning a smear positive for gonococci was obtained. Sulfathiazole and sodium citrate 1 gr. of each were prescribed every four hours after an original internal dose of 2½ gr. The usual irrigations with solution of sulfathiazole were also used. In this particular case both eyes were infected. The first of three successive negative smears was returned 24 hours after treatment was instituted. The child was discharged with no corneal involvement.

Case 4. A. F., colored, male, aged 24 years, was admitted on November 21, 1940, three days after his right eye became red and he felt a burning sensation. He had had a gonorrheal infection four months before, but there was no evidence of this on admission. He reported sexual relations three days before onset of his symptoms. The typical lid and conjunctival changes were present and the cornea showed some haze on admission. The day after admission the right eye was still positive. On the second day the right eye remained positive, but on the third day the first of three successive negative smears was obtained. This patient was given 40 gr. of sulfathiazole immediately, and this was followed by 15 gr. every four hours. Irrigations with a 0.2-percent solution of sulfathiazole, cold compresses, and a 1-percent solution of atropine were used locally. A Bullar shield was placed over the uninvolved eye.

Case 5. M. L., white, female, infant, was delivered at home by a physician 13 days before admission. No Credé prophylaxis was used. A smear from each eye was positive on the night of admission, and continued to be positive the following day and the next day. Three successive negative smears were then obtained. There was no corneal involvement in either eye on admission. This particular child had acute arthritis of the fourth and fifth fingers of the left hand and also had a gonorrheal vaginitis. She was given sulfathiazole internally in a dose of 1 gr. every four hours and irrigated with a 0.2-percent solution of sulfathiazole every 10 minutes. The interval between irrigations was lengthened to 20 minutes on the third day after admission and on the following day to one hour; later it was increased to two hours.

The use of sulfathiazole locally and internally in five cases of gonorrheal disease of the human eye at the Philadelphia General Hospital has met with the same satisfactory results obtained in the last cases treated with sulfanilamide and reported in the aforementioned paper. The results of treatment of this disease with sulfathiazole cannot be said, from our experiences, to be better or less efficient than those obtained with sulfanilamide. The technique of treatment and dosage of both drugs was essentially the same. The use of frequent irrigations during the first 24 hours of treatment is believed to be a very important factor in the good results obtained. Nursing care, conducted by nurses working in pairs on eight-hour shifts for the first 24 hours, is also a factor that has contributed a great deal to the success of this clinical trial. The end results with no corneal complications and decreased time of hospitalization are factors which are most appealing in the use of this type of treatment.

The sulfathiazole used in the treatment of these cases was furnished by E. R. Squibb & Sons.

2025 Locust Street.

CLINICAL PHOTOGRAPHY WITH SPECIAL REFERENCE TO PHOTOGRAPHY OF THE ANTERIOR SEGMENT OF THE EYE

DONALD WEEKS BOGART, M.D.
New York

A very simple yet highly efficient set-up for the photography of the lids and anterior segment of the eye has been employed in my office and by the Photographic Department of The New York Eye and Ear Infirmary for the past three years. Its low cost, extreme adaptability, and usefulness prompt me to present it to the profession.

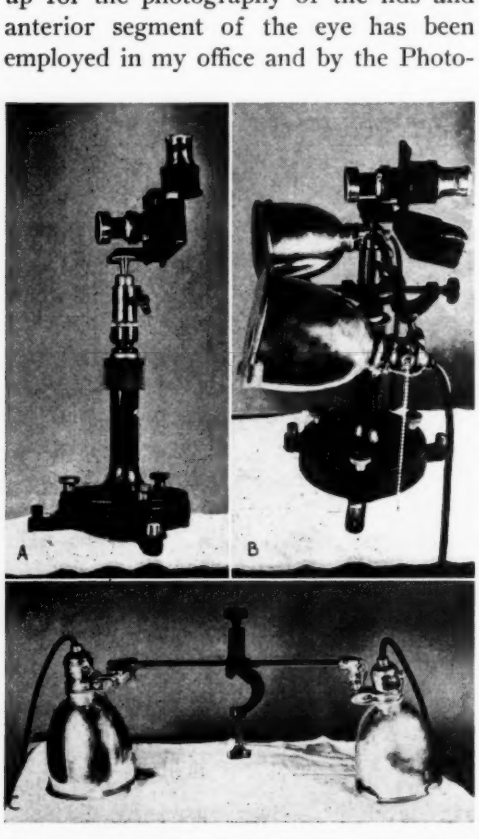


Fig. 1 (Bogart). A, Leica camera attached to "Speed-O-Copy" with one extension tube added to lens for close-up picture, mounted on slitlamp base (binocular head removed). Ball-and-socket tripod head attached to milled head joins camera and base. The camera is in position for taking the picture (the focusing device is raised to the vertical position).

B, The lamps in reflectors with obturators have been added. Note that the camera is lowered here and the focusing device is in place, preparatory to focusing the image of the eye.

C, detail showing reflectors mounted on rod and attached to large clamp ready to clamp on slitlamp base.

Photographic records are easily obtained provided they relate to a part accessible to ordinary cameras. The eye with its appendages—lids, cornea, iris, and even lens (under certain conditions)—may be classified as accessible. It is, of course, not necessary to state in detail the extreme value of photographic records of unusual conditions for teaching purposes, medico-legal purposes, and pre- and post-operative data.

The advent of Kodachrome film provides a medium for full-color recording of our medical data and makes it almost imperative for every ophthalmologist to use it as a means of recording his work.

A camera is the first essential. Any camera will do that may be focused visually and to which may be fitted front lenses (portrait lenses) or extension tubes (to increase the distance between plate and lens for close-up work). The miniature camera of the Leica, Argus, Contax, or Exacta type or a medium-sized reflex camera of the Rolleiflex or Graflex type is the best suited. A camera of the non-visible focusing type may be used provided accurate data are followed in setting the focus.

We have used the "Leica Standard" model with a "Speed-O-Copy" focusing device. The "Argus C-2" or "C-3" may also be used with the "Speed-O-Copy." The Leica sliding copying attachment may be used as well as the "Speed-O-Copy."

The Exacta and Rolleiflex cameras are, of course, reflex and need only extension tubes or front lenses (with prisms in the case of the latter to adjust parallax for close-up work).

The next requisite is a device to hold the patient's head firmly and a device that can be moved for focusing to be used as a camera stand. Any slitlamp stand provides both these needs most adequately. It is but necessary to remove the binocular microscope head and replace it with a camera. A rod milled to screw into the tripod receptacle adapts the camera (fig. 1, A).

Light (intense and of small aperture to minimize corneal reflexes) is to be had by means of No. I photoflood lamps mounted in "Sun Ray" reflectors with the ends covered by obturators easily made of "sheet tin" having 1½-inch diameter circular holes in the centers (fig. 1, B). The lamps are clamped on a rod which, in turn, clamps to the vertically movable portion of the slitlamp head (fig. 1, C). Above this fits either an adapted tripod head or a small connection which fits into the aforementioned slitlamp head below and the copying device and camera above (fig. 2). Extension tubes on the lens extend it to make a one-to-one copying ratio possible (the eye filling the entire field of view for extreme detail close-up work).

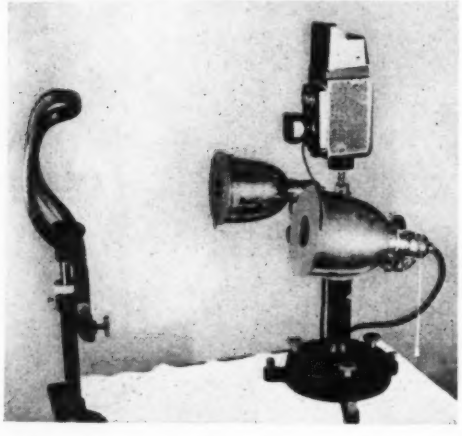
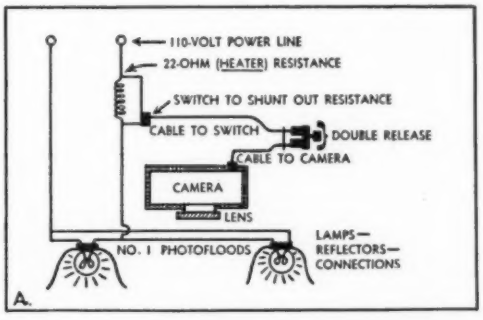


Fig. 2 (Bogart). The set up employing the Rolleicord (reflex type) camera. Note the head rest to insure keeping face and eyes in position.



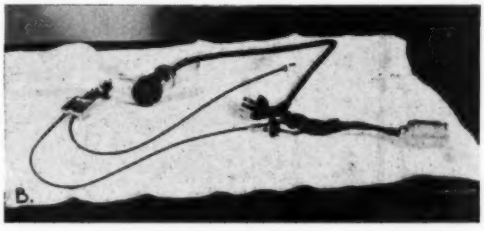


Fig. 3 (Bogart). A, detail diagram of connections for the synchronization of lights and camera. A 22-ohm heater resistance carries the current and makes the lamps burn dimly for focusing. Pressing the double cable release shunts out the resistance, causing the lamps to burn at full illumination—and a split second later (in the same maneuver) the camera shutter is actuated, making the picture before the patient can blink. The switch to the resistance is so connected that its cable is slightly longer, thereby closing its circuit shortly before the other cable release clicks the camera shutter. A "Ley" synchronizing switch may be used in place of the double cable release.

B, the synchronizing device. Note the following: (1) Double cable release. One cable goes to camera (not shown) and the other goes to the switch which shunts out the 22-ohm heater resistance. (2) Socket in center provides attachment for photofloods. (3) Pronged socket attaches to power line. (4) Socket at the right holds the 22-ohm heater resistance.

The eye will not tolerate full illumination from the two superimposed spotlights except for the duration of the exposure. For focusing, therefore, we have

arranged a switch which allows the current to go through a 22-ohm heater resistance (fig. 3, A). This greatly reduces the illumination but at the same time allows enough light to pass for focusing. The switch is so connected to a cable release that the resistance may be shunted out, allowing the full current to pass through the lamps for the exposure (fig. 3, B). The cable release is connected by means of a so-called double release with a second which actuates the shutter of the camera. It is possible to use a special synchronizing switch that would eliminate the double cable release and switch for the shunt. One such device is the "Ley Synchronizing Switch." I have used the double-release system, however.

When the desired focus is obtained, the camera is moved into position and the cable release is actuated with the finger. The light goes on to full, and a split second later, in the same motion, the shutter is tripped. A synchronization of light and shutter is thereby produced, making it possible to take the photograph before the patient can wink and blur the film (fig. 4).

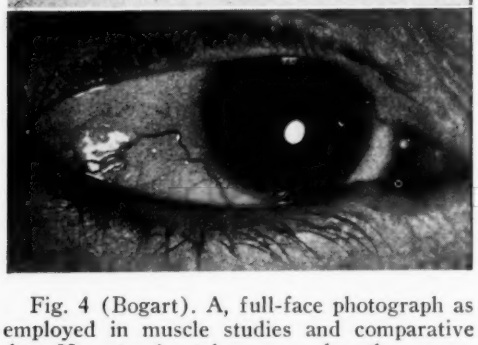


Fig. 4 (Bogart). A, full-face photograph as employed in muscle studies and comparative data. No extension tubes are used on the camera lens for this type of picture.

B, close-up picture for detail. Note the very small corneal reflexes obtained by the obturators which allow quite ample illumination. Extension tubes and more exposure are needed for close-up work.

It is possible, using the same lighting and focusing device, to make copies in any size for records or teaching. Instead of a slitlamp head, we use a base board and copying stand, such as the Leitz copying stand. Alignment and focus are obtained by moving the camera and slid-

Fig. 5 (Bogart). Set-up used for copying. The camera and lamps are moved vertically on the upright post of the copying stand. It is also possible to attach the lamps to the upright post to allow more ease in moving the camera in focusing and to keep the illumination more uniform.

ing arm (to which the previously used lights are attached) vertically on the upright (fig. 5).

The same unit described may be employed for photomicrography, using a simple coupling between the lens of the camera and the eyepiece of the microscope (depending upon the type of camera). Suitable illumination is necessary and is reflected from the substage mirror of the microscope. It is, of course, possible to use more elaborate apparatus for better results. Figure 6 illustrates the set-ups.

The technique of taking a photograph, with special reference to color film, is relatively easy. For full-face photography no extension tubes are necessary. The camera and lights are connected to the slitlamp base and centered on the patient's face, which is held firmly in the chin rest. The patient closes his eyes, and a reading is taken on the exposure meter, which indicates the lens aperture and speed. Films are rated in units depending upon exposure meter used, and these data should be followed.

Kodachrome "Type A" (for artificial light) is the type employed. In the case of the Leica or Contax cameras 35-mm. film is used. This may also be used with a certain model of the Exacta. There is another size Exacta, requiring a special adapter; 35-mm. film to be used in the Rolleicord or Rolleiflex camera necessitates a special back for the camera. One may, of course, use cut film in either of these. Agfacolor or Dufaycolor film is also be employed but we have had most satisfactory results with Kodachrome. There are several other less expensive cameras that may be adapted to this set-up.

Should the clinician possess no exposure meter, a rule-of-thumb exposure which works very well with color is to set the diaphram at F5.6 and expose at one twentieth of a second. The focusing is done in the ground glass of the copying attachment with the lens at full aperture. It is then stopped down to F5.6.

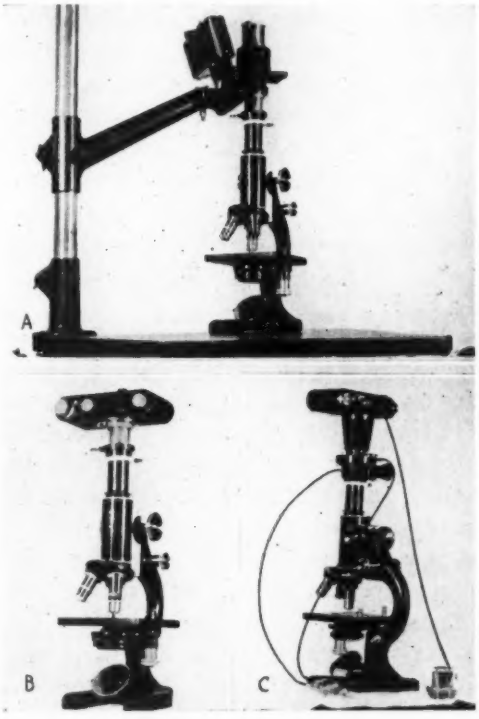


Fig. 6 (Bogart). A, Microscope (illuminating device not shown) attached to camera and "Speed-O-Copy" which is supported on arm and upright of copying stand. This is used for visible focusing of microscopic materials. Note that the camera is moved back and the focusing device is in place.

B, microscope and camera coupled together for photomicrography in the "infinity" position. Visible focusing after attachment of the camera is not possible. This is the simplest set-up, the microscope being focused before the camera is attached.

C, microscope, camera, and the Leitz Micro-Ibso attachment. This device is the most satisfactory arrangement for the Leica owner, and surely the easiest to use.

The camera is moved into place and the exposure is made..

In photographing the movements of the eye, we usually take the pictures in the six cardinal positions of gaze and with

the patient looking directly at the lens and at a theoretically distant point with and without glasses. For full-face work, the obturators on the lamps may be removed. In taking extreme close-ups, it is necessary to use extension tubes totaling either 3 or 4 centimeters, or suitable front lenses. The illumination must be readjusted so that the light superimposes and the obturators must be in position. It is well to take these closer exposures at one twentieth of a second at F5.6 unless lens detail is wanted, in which case one twentieth of a second is necessary at F4.5 or F3.5.

We have discussed the use of color film only. For ordinary purposes I prefer to use Agfa Superpan Supreme for black-and-white pictures. The black-and-white film is very much faster than the color, and exposures should again be predetermined by a suitable exposure meter. Due to the wide latitude of the film, exposure having been once determined, it is not necessary to consult the meter frequently, as is the case with color. A rule-of-thumb exposure for close-ups and full faces for this type of film is one hundredth of a second at F5.6. Extension tubes call for slightly more exposure as a rule.

I use Champlain No. 15 for development and print my pictures on a glossy paper, having preference for Agfa Brovira, double weight, normal or hard (depending on the contrast of the negative). I ferrotype the prints to bring out the detail. The enlargement that is most valuable is approximately 3½ by 4¼ inches. The color film is processed in Rochester by the Eastman Kodak Company and is returned as a small transparency which may, in turn, be printed in color.

Photography of the fundus oculi is not at present feasible with this type of apparatus. The low cost of this equipment makes it possible to use a better grade of camera than is employed in the complete commercial set-ups offered for sale. One such device claims small corneal reflexes, but the apparatus described herein produces similarly small reflexes and gives considerably more light for the exposures; and the simple resistance and shunting device used is much simpler than many of the bulky commercial resistances. It is possible to set up this apparatus at very little extra expense, utilizing apparatus already at hand in every ophthalmologist's office.

All the parts may be obtained and apparatus adapted through Clairmont & Nichols Company, opticians of this city. Mr. Aurel Mangold of that firm made possible the detail work on my apparatus.

20 East Fifty-third Street.

NOTES, CASES, INSTRUMENTS

HEREDOMACULAR DEGENERATION*

Two cases of the adolescent type

THOMAS A. O'BRIEN, M.D.,† AND KENNETH L. ROPER, M.D., M. SC. (MED.)‡
Hanover, New Hampshire

A number of conditions of a hereditary nature and with a familial incidence are classified under this heading. They are characterized by bilateral degenerative changes in the macular area without degenerative changes in the central nervous system.

The changes seem to occur at the transitional periods of life: those observed at birth, the infantile type; at the second dentition (6 to 8 years), the juvenile type; at puberty (12 to 15 years), the adolescent type; at the end of the growing period (20 years), the adult type; at the beginning of senile regression (45 to 50 years), the presenile type; and in senility, the senile type.

Hutchinson,[1] in 1875, first described bilateral degenerative macular changes. The condition occurred in three sisters aged 40, 48, and 57 years. He stressed the familial character of the condition.

Batten,[2] in 1897, gave the first description of a distinct type which occurred in two brothers at puberty. After 28 years[3] they were both in good health, but the central scotoma persisted.

Best's[4] report, in 1905, presented the occurrence of a similar macular degeneration in eight members of a family which was unquestionably congenital in incidence and one of these distinctive types.

In 1909 Stargardt[5] described the occurrence of familial macular degenerative lesions at puberty and the type for a time became known as Stargardt's disease.

Behr,[6] in 1920, described cases of the adult type, which became known for a time as Behr's disease. In like manner Vossius[7] (1921) and Weisel[8] (1922) described cases seen after the second dentition.

A number of other conditions are closely related to this group in that they exhibit familial dystrophies of the tapetoretinal type affecting the central area. Doyne's honeycomb choroiditis is a closely related condition. In this disease there are massive deposits of colloid material about the perimacular area which lead to eventual degeneration of the central area.

Certain cases of congenital macular colobomata of familial occurrence, sometimes associated with skeletal anomalies, may have a similar or identical basis. The familial types of peripapillary and central choroidal sclerosis, classed by Leber[9] (1916) as tapetoretinal degenerations, are also probably closely related.

The macular lesions themselves are similar in the large number of cases described with associated symptoms of central-nervous-system involvement, which occur usually before puberty. Oatman termed such cases familial maculocerebral degeneration. It seems reasonable to assume that the earlier the lesion appears, the more severe it is, and the more likely to be associated with mental symptoms; and that cerebral symptoms do not occur when the lesion becomes manifest after puberty.

*From the Wills Hospital, Philadelphia, Pennsylvania.
†Deceased, June 21, 1941. Formerly attending surgeon, Wills Hospital.
‡Formerly resident surgeon, Wills Hospital.

Pathologically, the lesions consist of a gradual atrophy of the cones in the macular area with the migration of pigment granules from the pigment epithelium to the surface of the retina. There are no vessels in the macular area and hence the pigment assumes the shape of dots and not the "bone corpuscle" figures as in retinitis pigmentosa.

Fig. 1 (O'Brien and Roper). Heredomacular degeneration, adolescent type, in two sisters. A, fundus of the left eye of the older sister; B, fundus of the right eye of the younger sister; C, the assumed congenital lesion in the fundus of the right eye of the older sister.

Report of two cases

Two sisters, white, aged 14 and 18 years, were patients on Dr. Thomas A. O'Brien's service at the Wills Hospital in October, 1940.

Their only complaint was poor vision. In the case of the younger sister defective vision had been present for three years, and in the case of the older, for five years. In both patients, central visual acuity was 6/60, in each eye, without glasses. The younger sister was hyperopic and the elder, myopic. Correction of their refractive errors did not improve their vision. The symptoms were slight in both cases and were not incapacitating.

Meinicke and blood Wassermann tests were negative. Blood-chemistry and blood-count studies were all within normal limits. Two badly decayed teeth were removed from the older sister and her tonsils were noted to be chronically infected. The younger sister had one infected tooth extracted. The ear, nose, and throat examinations were negative. The intracutaneous Mantoux test was negative in both. X-ray studies of their skulls were also negative. From a general medical standpoint they were both considered normal, healthy young girls. In neither was there any evidence of cerebral involvement in the form of mental backwardness. The younger sister showed a relative central scotoma with small test objects and a slight confusion of color vision in the central area. In the case of the older sister, fixation was eccentric and attempts to outline her blind spots and any central field defects were futile. Standard color tests indicated incomplete red-green blindness in her instance. Peripheral fields showed no contractions in either case.

Clinically the maculas showed chiefly definite pigmentary disturbance in rather clearly defined areas, reddish to yellow in color. The pigmentation was a fine punctate stippling which could well be described as a pepper-and-salt macula. In one macula of each patient blotches of pigment appeared as well as grayish-white flecks like colloid bodies confined to

the central areas. Interspersed between the fine pigment dots were yellowish-red areas indicative of hyaline degeneration. There was some pallor of the temporal sides of each disc indicative of some associated atrophy of the optic nerve (fig. 1).

In the right eye of the older sister, lying close to the disc at about the 7-o'clock position, was a round, circumscribed area that appeared slightly depressed. It was surrounded by a finely dotted pigment line, was reddish in color, and a retinal vessel traversed it. This lesion was no doubt of congenital origin and only coincidental to the macular lesions. It was thought to be a failure of the pigment layer to develop there, for as one looked carefully the pigment layer at the edge of the depression could be seen (fig. 1).

The familial character of the condition in these two cases was maintained in that the two affected sisters of the family were approximately alike with regard to the time of development of the degenerative symptoms, the nature of the lesion, and its rate of progress and general evolution.

The influence of heredity in the determination of these two cases of macular degeneration is seen in the strongly familial incidence—two sisters out of a family of six being affected. No similar lesions were found in the other four children, nor in the eyes of the father or mother. No other family history was obtainable, and there was no parental consanguinity as far as could be determined.

It is interesting to report here, the studies made of a still younger sister of these two patients, aged 13 years. She had a slight esotropia of her left eye and a fairly large, absolute central scotoma in the same eye. There was no macular disturbance seen; in fact, there was no evidence of pathological change noted in the fundus of either of her eyes. It was believed to be a scotoma associated with the apparent amblyopia in that eye.

Clinical Division,
The Dartmouth Eye Institute.

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REMOVAL OF A NONMAGNETIC FOREIGN BODY FROM THE VITREOUS

JOSEPH A. SCHUTZ, M.D.
Buffalo, New York

There are many reports in the literature of attempts to remove nonmagnetic intraocular foreign bodies, such as glass, wood, lead, brass, copper, stone, and alloyed metals.

Most of these foreign bodies have been removed from the eyeball through a posterior scleral incision, and usually with forceps. If the point of entrance was in the sclera behind the ciliary region, an attempt was usually made to remove the foreign body through this opening, unless the object was localized too far from the entrance wound.

The usual occurrence is that the injured eye has suffered a severe intraocular hemorrhage, and if the foreign body is successfully removed, the eyesight is generally impaired and most frequently lost.

In 1909 Sweet introduced his method, which made accurate localization possible, but, even with this improved aid, the successful removal of nonmagnetic foreign bodies is a problem to the ophthalmologist.

In recent years Cross reported his method of removal, the first step being localization by means of X-ray studies, then removal with his cross action forceps, introduced through a posterior scleral incision. The removal, directed by a radiologist, is done under the biplane fluoroscope. The result in most of the cases reported was very poor or complete loss of vision. Cross reported a case in which the removal of lead shot was accomplished with his special forceps under fluoroscope control and in which the patient recovered uneventfully, retaining normal visual acuity.

Many cases have been recorded of removal of foreign bodies from within the eyeball with preservation of the globe but with loss of vision.

Borley and Leef report an interesting case of lead-shot removal from the vitreous with a forceps fashioned after Cross.

Accurate localization by X-ray studies is very important, especially if the patient has but one eye. Errors in localization do occur and are not uncommon. It is wise and justifiable to consult two or more roentgenologists.

The following case report is unusual in that an intraocular foreign body was successfully removed from an eye which subsequently regained normal visual acuity.

On October 29, 1940, J. J., aged 15 years was seen.

One hour after an accident in which the right eye was injured from the explosion of a bullet in a bonfire, the eye showed a horizontal linear perforation, about 6 mm. long, at the horizontal meridian on the nasal side. The perforation extended from a point 7 or 8 mm. from the limbus toward the posterior of the eye, having just missed the ciliary region. The pupil was slightly smaller than that of the uninjured eye and reacted readily to light and accommodation. The anterior chamber was clear, the lens uninjured. The visual acuity at this time was 10/200. After complete pupillary dilation with atropine, the ophthalmoscope revealed a cloudy vitreous with air bubbles and small hemorrhages present. At the ora serrata there was an elevated whitish pigmented patch. This flat area of retinal detachment extended about 2½ to 3 P.D. posteriorly. A small object with a metallic luster was discernible floating directly in front of the detached area.

Radiographic examination was reported as follows: "The right orbit shows an opaque foreign body approximately 4½ by 1½ mm. in dimension. By locali-

zation, the foreign body was found to be 1 mm. above the horizontal plane of the cornea, 10 mm. to the nasal side of vertical plane of the cornea—localization made to the mid-point of the foreign body."

At the large magnet the foreign body proved to be nonmagnetic. This was expected, for a bullet wound would most likely reveal that either copper or lead had penetrated. An injection of 9 c.c. of boiled milk was given intramuscularly, and the patient was hospitalized.

The hazard of not enucleating the eye was fully explained to the parents. The consent of the parents was obtained for enucleation, but I decided first to try to remove the foreign body.

Under local anesthesia, with the pupil widely dilated, the original incision was extended 2 mm. posteriorly. The patient's head was tilted to the right. In a procedure similar to transilluminating the eyeball, two small powerful lights were gently but firmly placed against the eyeball at the 11-o'clock and 6-o'clock positions. A third similar light was used to illuminate the wound area. Upon separating the lips of the scleral wound, the glistening metallic substance was easily seen and grasped with long, narrow, curved forceps, similar to the Hess iridectomy forceps, the tips of which were flat and corrugated. Following the extraction of the foreign body, the sclera and conjunctiva were sutured. Antiseptic and atropine solutions were instilled.

The foreign body was found to be a piece of copper shell 5 mm. long by 2 mm. wide. Recovery was uneventful, and on November 10, 1940, the eighth postoperative day, the patient was discharged.

On November 15th, the visual acuity uncorrected was 20/40, with a correcting lens 20/20.

The slitlamp revealed a few pigment floaters in the anterior chamber. The lens was clear, the vitreous slightly cloudy; blood pigment was present. Ophthalmoscopy disclosed a hazy vitreous. The area at the site of entrance of the foreign body showed reattachment of the retina, with connective-tissue formation.

The patient was last seen on November 29, 1940, one month from date of injury. His uncorrected visual acuity at this time in the injured eye was 20/20.

Summary

A small, nonmagnetic foreign body was removed from an injured eye, after X-ray localization. The affected eye was not injured in the ciliary region and did not, at any time, reveal external signs of intraocular inflammation. Normal visual acuity was regained.

This case report indicates that it is occasionally possible to remove nonmagnetic bodies from the vitreous without visual impairment.

2804 Main Street.

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ANILINE-PENCIL CYST OF THE ORBIT*

A CASE REPORT

LESLIE C. DREWS, M.D.
Saint Louis

W. S., a white man, aged 35 years, referred by Dr. A. J. Signorelli, came to me on January 28, 1937. He stated that three months previously (October 24, 1936) while scuffling with a friend he had run the sharpened end of an indelible pencil through his left upper lid. He did not know how far into the orbit the pencil penetrated, but his friend had to draw it out. Without any questioning he volunteered the information that the end of the indelible lead was found to be missing, and that a fruitless search was made for it at the scene of the accident.

He received "first aid" from a friend, the wound healed in two or three days, but about 10 days after the accident the upper lid started to swell. The swelling became very marked about three weeks after the accident so that he could not open the eye. Sometime after the swelling started, very troublesome diplopia set in, and the patient was laid off from his job as truck driver.

He consulted an ophthalmologist about December 15, 1936, who had an X-ray film of the orbit made. It proved to be negative. He then started treatment with potassium iodide under another ophthalmologist and continued the treatment to date. About two weeks ago he spit out a large quantity of deep-blue mucus, and on blowing his nose some of the blue mucus was discharged from his nose. His ophthalmologist assured him he must have imagined this, and thereupon he decided to consult someone else. The lid swelling decreased definitely after discharge of this blue mucus.

He showed a marked swelling of the upper lid, which was pressed far downward covering the cornea. The left eye also was pressed far downward (15 mm. below the horizontal plane) and slightly outward. A large hard mass occupied the upper inner angle of the orbit. It was immovably fixed to the orbital roof and seemed fluctuant. There was only a slight inflammatory reaction in the lid and this seemed passive. The picture simulated meningioma of the roof of the orbit.

Vision O.D. was 22/12; O.S., 22/60-38 (Green-Ewing charts). The vision of the left eye could not be improved with lenses nor with the stenopeic disc. Visual fields with 1-degree white target on the Ferree-Rand perimeter were fully normal. Besides the displacement of the entire globe, there was a left hypotropia with screen test which seemed to be of about 25 prism diopters, and a left exotropia which seemed to be of about 10 degrees. Rotations were restricted approximately to 10 degrees up and in, 20 degrees up and out, 30 degrees inward, and elsewhere normal (over position of rest). Exophthalmos by ruler measured 16 mm. O.D., 26 mm. O.S.

Ophthalmoscopic examination showed the media clear and fundi normal. There was no evidence of retrobulbar pressure.

A rather large cutting needle was pushed with considerable difficulty into the mass, and 2 c.c. of thick chalky blue mucus was aspirated.

Next day and the day after, the visual acuity remained the same, but four days later vision O.S. was 22/30. Operation upon the cystic mass was advised, the exact course to be determined at operation.

Operation. On February 4th, under ethylene anesthesia at De Paul Hospital, the eyebrow was shaved and an incision 35 mm. long was made in the brow. Starting at the nasal end, it was carried down to the periosteum,

* From the Department of Ophthalmology, Saint Louis University. Read before the Saint Louis Ophthalmic Society, January 27, 1939.

avoiding the supraorbital nerve trunk, passing around the superior nasal margin of the orbit, and exposing the cystic mass. This seemed to arise directly from the bone so that it could not be separated from the roof of the orbit. It was not sharply delimited from the orbital tissue. A 1-cm. incision through the dome of the cyst anteriorly was made, with escape of about an ounce of thick chalky blue mucoid fluid. The cystic wall here was 3 to 4 mm. thick and very tough. The cystic cavity was washed thoroughly many times, 3 liters of normal saline being used before the wash returned clear. There was no escape of fluid into the nose, nor was any attempt made to force fluid into the nose. The cyst was found to be about 15 mm. in diameter, roughly circular, gradually tapering to a fine opening near the apex of the orbit. A small probe was passed backward 45 mm. from the level of the supraorbital ridge without any force. The roof of the cyst in its anterior 25 to 30 mm. was the bare bone of the roof of the orbit, which was very rough posteriorly. There was no evidence of any ramifications from the main body of the cyst. The cyst was lined with fibrous tissue stained deeply blue. A rubber-dam drain was inserted, the skin wound sutured and a bandage applied.

Postoperative healing was uneventful. Considerable blue discharge at first was present; it gradually decreased. On February 16th (12 days postoperative) only a 5-mm. wide sinus remained open, and the patient had binocular fixation. The left eye was depressed perhaps 5 mm., and rotations were approximately up-and-in 20 degrees, up-and-out 30 degrees, inward 40 degrees, elsewhere normal.

Blue material continued to discharge from the sinus, which closed down to a 2 to 3 mm. hole. A long blunt hollow needle was daily passed into the depths of the sinus (1½ inches from the skin) and the sinus was irrigated. Within six weeks the exophthalmos disappeared. The visual acuity gradually rose until on May 22d it was found to be 22/12 O.D. and O.S. No bone spicules were ever found in the discharge.

On July 17th the patient reported that he had been back at work for two months. The external ocular movements were grossly normal. The left eye remained depressed, perhaps 2 mm. The sinus tract had been irrigated daily by the patient's general physician, who had begun to despair of eventual healing. The tract was still 30 mm. long. However, it rapidly closed up so that in two weeks the sinus tract was healed. It has remained healed to date (December, 1940).

Indelible pencils, according to Duke-Elder (Textbook, volume 2, page 708), are most commonly made of methyl violet, an aniline dye. Copying pencils, and also copying ink are often made of the same basic material. This chemical is extremely corrosive in the conjunctival sac; very serious injury has followed its accidental or deliberate introduction into the conjunctival sac, resulting in symblepharon, deep corneal necrosis, hypopyon ulcer, and even loss of the eye.

What happened to the indelible pencil point in this case? What happened in the orbital tissues which enabled them to localize such a cauterizing substance? I believe it most likely that the pencil point was thrust up against or even under the periosteum of the roof of the orbit; the periosteum then proliferating peripherally while the central scar tissue, laid down to encapsulate the mass, was being slowly destroyed. In this way the cystic mass may have been formed. Histological examination of some of the wall of the cyst showed simply dense scar tissue, the inner stained layers of which were necrotic. It seems unlikely that the aniline dye was thrust through the roof of the orbit into one of the sinuses. But unfortunately we were unable to determine how the

aniline dye did eventually get into the nose. Again I wish to emphasize that no channel from the cyst into the nose was demonstrated at any time during any of the irrigations of the cyst. Doubtless some communication to the nose was established when the blue fluid was discharged from the nose and the cyst decreased in size.

The original decrease of visual acuity must remain unexplained. Central field tests were not made. The narrow posterior end, or the apex, of the cyst certainly was close to the optic foramen. In all probability pressure upon the optic nerve near the apex of the orbit interfered with the function of the papillomacular bundle.

Considerable question arose before operation as to whether an attempted excision *in toto,* or simple drainage should be done. We do not know whether the intracystic fluid was still corrosive or not. Therefore a spilling of the cystic contents into the orbital tissues was studiously to be avoided. The fluid could wisely have been saved so that tests could have been made later, but unfortunately this was not done.

After finding how extensive the cyst was we were thankful that simple incision, irrigation, and drainage had been chosen.

516 Metropolitan Building.

THE LINEAR-STREAK LAMP

(Pocket "slit"lamp)

Henry Minsky, M.D.
New York

The universal acceptance of Vogt's work with the Gullstrand diaphragm lamp and the Czapski binocular microscope brought with it the realization that a great disparity existed between the usual dark-room examination of the eye and the precise scrutiny afforded by the slitlamp microscope.

Most of the usual work was done with the ×10 magnification. For almost all the rest the ×25 was employed, since higher magnifications are difficult to manipulate and are open to serious objections. It soon became apparent that the practical benefits of slitlamp work were to be obtained with the lower powers. Consequently the ophthalmic surgeon accepted the implied challenge to improve his technique of focal illumination. Many small lamps, most of them combined with magnifiers, were developed whose function was to act as pocket slitlamps.

The purpose of this communication is to describe the technique of using a pocket linear-streak lamp that was developed at the New York Eye and Ear Infirmary on the services of Dr. John M. Wheeler and of Dr. Conrad Berens. A preliminary report was read at the Brooklyn Ophthalmological Society in December, 1924, but has never been published. However, the passage of time has compelled a fuller appreciation of the value of this instrument. The conviction has grown that its use, because of its simplicity, deserves a place in the routine examination of the eye, particularly at the bedside or in the operating room where the slitlamp microscope is either not available or its use has been found impracticable.

Essential requirements of a linear-streak lamp. After experimenting with several types of small commercial bulbs, condensing lenses, and small diaphragms, it was decided that the following components were essential for simplicity: (1) A source of energy—the small two-cell dry battery or rheostat with cord handle. (If a rheostat is used, the filament can be overloaded to obtain greater intensity of illumination.) (2) A small electric bulb

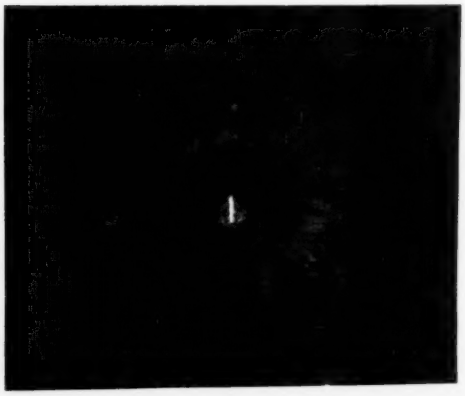
containing a single wire U-shaped filament with the convexity presenting and the arms precisely centered. (The spiral filament should be avoided since it cannot give a linear streak and necessitates the incorporation of a diaphragm.) (3) A strong plano-convex lens of short focal length that permits ready focusing of the image of the filament to a sharp linear streak. (The additional light caused by the inherent defects of spherical aberration and internal reflection could be turned to advantage. Graves, a long time ago, suggested the use of accessory illumination for purposes of orientation.) (4) Independence of the magnifier to allow the use of all the methods of observation and to permit progressive changes of magnifying power.

The instrument (fig. 1). When these requirements were found adequate and present within the structure of the May ophthalmoscope (or a similar ophthalmoscope), a new instrument was deemed unnecessary if not undesirable. Many physicians owned one. It was at hand, inexpensive, portable, and extremely satisfactory.

There are five components in such an ophthalmoscope, four of which deserve consideration for the linear-streak lamp, head of the ophthalmoscope having been removed: (1) The *battery handle,* or rheostat handle, is light enough for active manipulation. (2) The *light carrier* is a contact rod insulated from a surrounding cylinder, the end of which is threaded to receive the bulb. This light carrier is just long enough to rest on the bridge of the patient's nose in order to procure a steady source of illumination when using magnification of observation above ×10.

Fig. 1 (Minsky). Technique of illumination and observation. A, The linear-streak lamp, resting on the bridge of the nose, is focused on the eye and the loupe focused on the streak (retouched). B, The head of the observer has approached the aperture of the loupe.

(3) The small *electric bulb* with the inverted-U tungsten filament. When this filament is properly centered, the vertical arms of the U appear as an unimportant distortion at the extreme ends of the focused streak. If the filament is not properly centered, a linear streak will not be produced. It may again be stressed here that the spiral filament will not do because the focused image is too broad and irregular. (4) The *condensing cap* consists of a cylinder, one end of which is closed by a semispherical plano-convex lens. The open end fits on and may be slid over the base of the bulb, permitting the light to be focused to diverging, parallel, or converging rays. For use in both the linear-streak lamp and in the ophthalmoscope, the condensing cap is adjusted so that an image of the filament is produced about 2.5 cm. from the tip of the lens. At this focus the instrument becomes a system of fixed conjugate foci, the real image of which can be mobilized to impinge upon the anterior structures of the eye.



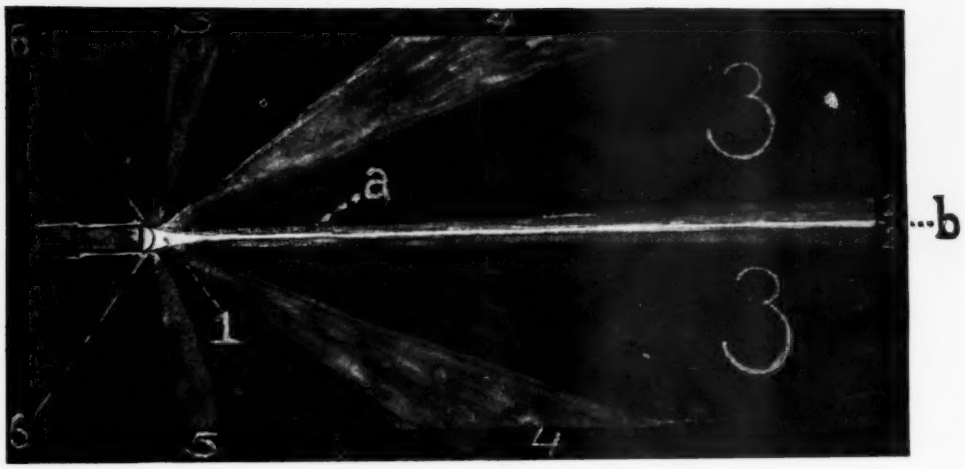


Fig. 2 (Minsky). Rays of light from condensing lens cap. 1. The central caustic cone focused at (a) to form the linear streak; (b) the central ribbon composed of slightly divergent rays. 2. Secondary conoid around central ribbon. Cross section is elliptical. 3. Penumbra of divergent dim rays giving contrast to central linear streak. 4. Bright oblique conoid outside of the penumbra. 5. Zone of fairly bright light almost parallel to plano surface of lens. 6. Narrow zone of totally reflected light.

Fortunately, this adjustment is ideal for using the ophthalmoscope in the direct image. There is, therefore, no necessity for doing anything more than removing the head of the ophthalmoscope when the linear-streak lamp is desired.

Path of rays (fig. 2). The rays emanating from the lens consist of: (1) A

central caustic cone of convergent light at the apex of which (a) the linear streak is formed to continue on as (b) a central ribbon of slightly divergent rays along the principal axis of the system, permitting the optical section of the eye. shadow around the central beam extending to 40 degrees. The base of this cone measured at the image of the filament is about 20 mm. Since the cornea is 12 mm. in diameter, the following three groups of brilliant rays fall well outside of the

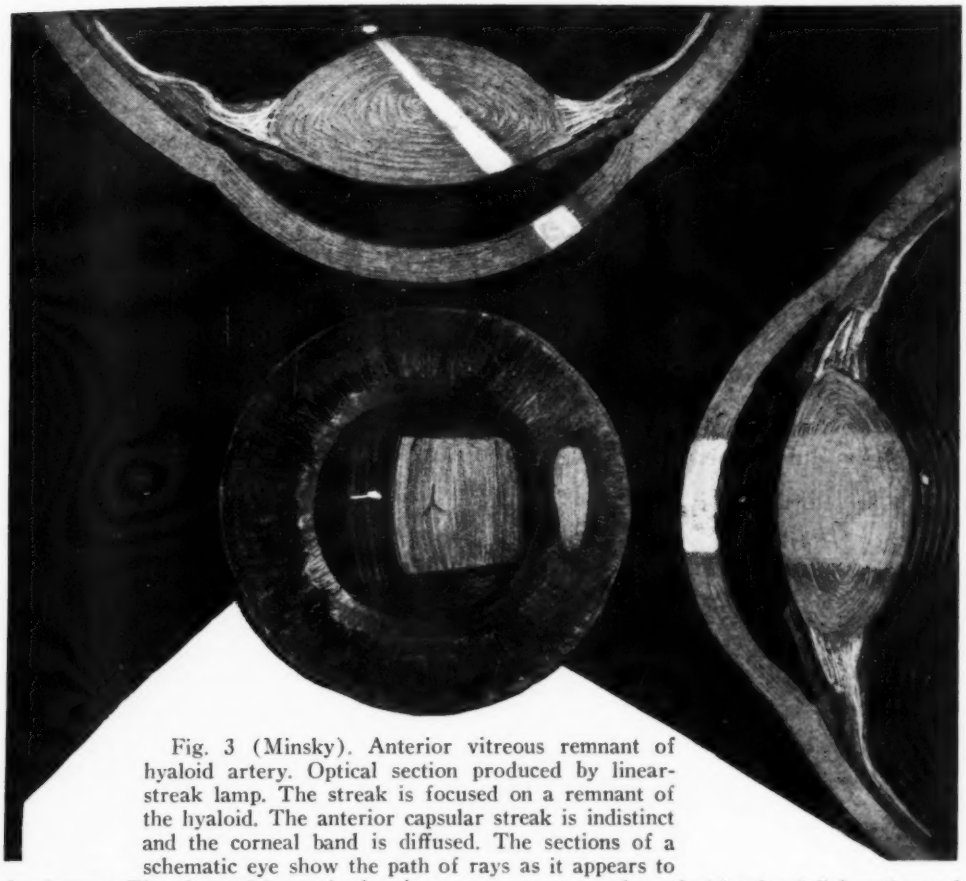


Fig. 3 (Minsky). Anterior vitreous remnant of hyaloid artery. Optical section produced by linear-streak lamp. The streak is focused on a remnant of the hyaloid. The anterior capsular streak is indistinct and the corneal band is diffused. The sections of a schematic eye show the path of rays as it appears to the observer. The pictured layers in the vitreous represent merely optical bands of disjunction and not necessarily structural morphology.

The other accessory conoids of light, being made up of divergent rays, producing a dim, diffuse illumination, serve to light up the whole eye. (2) A secondary conoid of somewhat less brilliant divergent rays surrounds the central ribbon and measures about 5 degrees. (3) A diffuse zone of very dim light which in contrast to the streak results in a relative limbus and are not important: oblique, tangential, and reëntrant bands.

Linear streak (fig. 3). The effect obtained with the linear streak is almost identical with that of the slitlamp when the slit is at its narrowest. Of course, the intensity of illumination is much less. The epithelium of the cornea is lit up by a brilliant line about 4 mm. long, from

which there is produced a true optical section of the cornea, aqueous, lens, and anterior vitreous. Parts of the relucent area that are farther from the lamp are, at the same time, on a plane farther posterior, since the direction of the light is oblique.

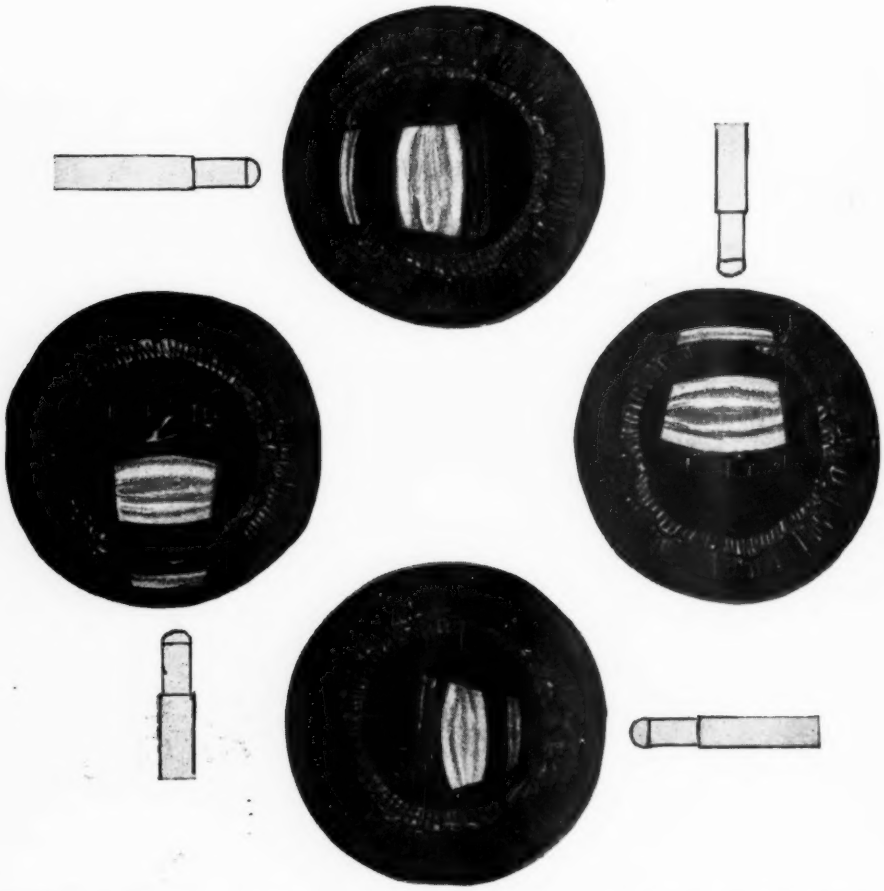


Fig. 4 (Minsky). Variation of axis of illumination. The same eye is pictured with the direction of light represented by the outline drawings of the lens cap and light carrier as coming from above, below, and from nasal and temporal sides. The linear streak is focused on the anterior vitreous "curtain-bands."

Technique of illumination. Obviously, the instrument must be in good condition and the battery fresh. The arms of the U filament must be parallel to the axis of the system, and the end-on-view must appear as a straight line. The cap, with its condensing lens, must be adjusted on the base of the bulb to produce a straight-line image 2.5 cm. from the vertex of the lens. If any factor is imperfect the lamp loses value, and good results may not be obtained.

For examination of the right eye the observer holds the lamp in the right hand (fig. 1a) so that the handle fits in the space between the thumb and index finger and the light carrier rests on the bridge of the patient's nose. Steady and accurate focusing of the linear streak is achieved

by resting the little finger on some convenient portion of the patient's head while the fourth finger directs the axis of illumination. A relaxed grip on the lamp is desirable so as to permit delicate manipulation of the brush of light, which literally sweeps through the media, gathering up in its path signs that are brought to the attention of the observer. The left eye is illuminated in the same way, but the lamp is held in the left hand.

The lamp is usually held so that the linear streak is vertical except when it is desired to use the beam horizontally or obliquely. The small instrument is much more flexible than is the slitlamp microscope, and much information may be gained through the ease of varying the axis of illumination. One can make observations on the eye not alone from the horizontal meridian, but from almost any point of the circle. For instance, the eye may be illuminated by the light directed from above or below (fig. 4). This method of illumination is almost impossible with the slitlamp microscope.

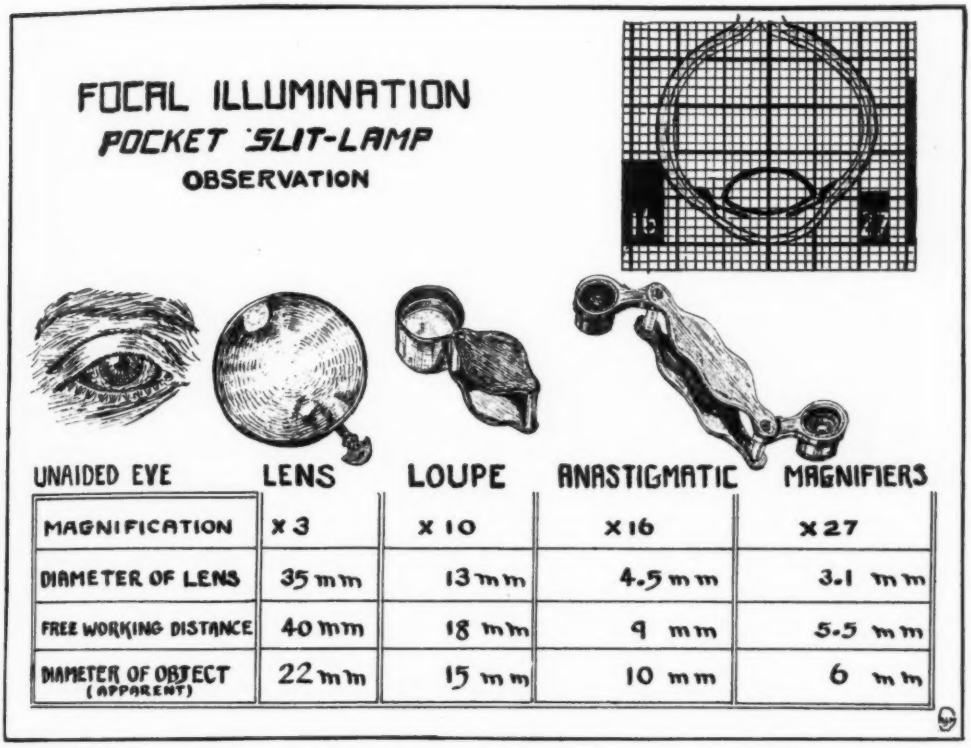

FOCAL ILLUMINATION
POCKET SLIT-LAMP
OBSERVATION
16
27
UNAIDED EYE
LENS
LOUPE
ANASTIGMATIC MAGNIFIERS
MAGNIFICATION x 3 x 10 x 16 x 27
DIAMETER OF LENS 35 mm 13 mm 4.5 mm 3.1 mm
FREE WORKING DISTANCE 40 mm 18 mm 9 mm 5.5 mm
DIAMETER OF OBJECT (APPARENT) 22 mm 15 mm 10 mm 6 mm

Fig. 5 (Minsky). Magnification. The schematic eye is taken from the Sweet chart for plotting intraocular foreign bodies. The black oblong marked 16 and 27 shows the relationship of free working distance of the respective magnifiers to the structures of the eye available to study. The lower powers could be plotted if the refractive properties of the eye were resolved by the Koeppe contact glass.

Hand magnifiers. Even with the unaided eye the linear-streak lamp offers a method manifestly superior to ordinary focal illumination with condensing lens, but its fullest value is appreciated when used with magnifiers. There is a temptation to use the higher powers at once, but more and better information may be

obtained if one proceeds in an orderly fashion. Eyes should not be studied with the linear-streak lamp until they have been observed in daylight and then by focal illumination in the dark room. Indeed, better slitlamp studies will be made if the use of the slitlamp is delayed until after the linear-streak lamp has been used.

A 20-D. lens giving a ×3 magnification may be used in conjunction with the linear-streak lamp. This lens has a free working distance of 40 mm. and an apparent field of 22 mm.

Although ×6 to ×8 magnification is usually used to great advantage, one is rarely satisfied with less than ×10 magnification after sufficient practice has been obtained. The latter has a free working distance of 18 mm., which allows as deep penetration of the anterior part of the eye as with the powerful slitlamp microscope (fig. 5). In fact, the anteriormost layers of the vitreous can, with little difficulty, be studied in thin optical section. The field of observation is the largest practical, being an apparent 15 mm.

When once something is noted with the ×10 loupe, it may be further examined under higher monocular magnification. Loupes of ×15 and anastigmatic magnifiers of ×16 and ×27 are available. The lens system magnifying ×16 is 4.5 mm. in diameter, has a free working distance of 9 mm., and gives an apparent field of 10 mm. With it one may penetrate to the posterior capsule, "retrolental space," and to the anteriormost layers of the vitreous. To obtain the full benefits of the loupe, it should be used much as if it were a lens in the ophthalmoscope, the observer's eye being placed close to the aperture of the lens system, according to the technique of approach described below. Especially necessary is this technique of approach in the ×27 magnification, which has a lens system 3.1 mm. in diameter, a free working distance of only 5.5 mm., and gives an apparent image 6 mm. wide. With this magnification one may view the cornea, aqueous, iris, and the anterior third of the lens. It should be employed only after the ×16 has been used and when the slitlamp microscope is not at hand. The dramatic aid in diagnosis is to be found at the bedside where the slitlamp microscope is neither available nor practical.

Technique of observation (fig. 1). Right Eye. Having first focused the light on the patient's eye, the observer places the magnifier in front of the linear streak at a distance equal to the focal length of the lens system (fig. 1A). The corneal loupe is held in the surgeon's left hand between the thumb and index finger, leaving the middle finger free to raise the upper lid, and the fourth finger to fix the lower lid. The observer brings his head forward, placing his right eye in front of the magnifier while the base of his thumb rests against his face to immobilize the loupe (fig. 1B). The precise focusing of the loupe is accomplished by moving his head backward or forward. For observation by parallax he moves his head from side to side. In this way the eye to be studied is more readily approached because one has to get almost as near the patient as when using direct ophthalmoscopy. Furthermore, this close approximation of the loupe to the observer's eye is the only way he can get the benefit of the maximum field of observation in the higher magnifications because, as we have seen, this field is markedly cut down in size.

Left Eye. For examination of the left eye the observer directs the light carrier in his left hand across the bridge of the patient's nose, the loupe being held in the

right hand close to the observer's left eye.

The value of this detailed technique of holding both the lamp and the loupe becomes evident when magnifications higher than ×10 are employed. Some practice is, of course, necessary to secure facility of manipulation of the linear streak and steadiness of the magnifiers.

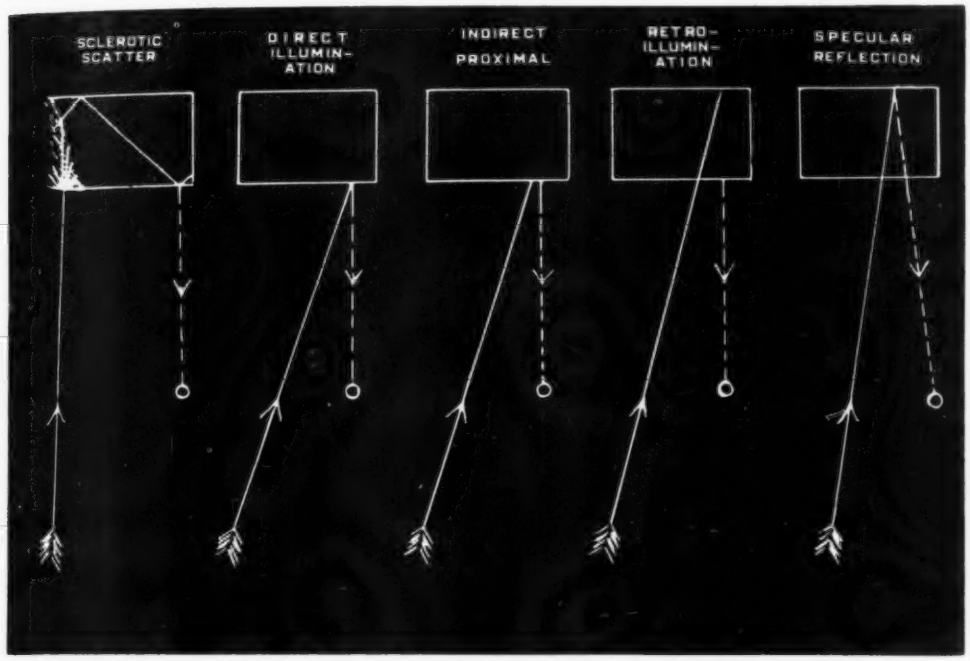


Fig. 6 (Minsky). Methods of observation. The cornea is represented by a rectangle. The axis of illumination is shown by a straight line. The axis of observation is marked by the broken line. The specific spot under study is located where the broken line starts at the oblong. Within the oblong for sclerotic scatter, the unbroken line represents the path of totally reflected rays. In that illustrating specular reflection, the angle of illumination equalling the angle of observation should be much greater.

It is important, when using the higher powers, to focus the loupe first on the linear streak itself and only then to approach the aperture of the loupe. It is rather difficult to reverse the procedure. When the part of the eye to be studied does not readily appear in the field of the loupe, the technique is to be repeated: streak focused on the eye, loupe held before streak, and then observer's eye brought to the loupe.

Methods of observation (fig. 6). All of the five routine slitlamp methods can be employed with this monocular technique: sclerotic scatter, direct illumination, indirect proximal illumination, retro-illumination, and observation along the line of specular reflection.

Such details as the circulation at the limbus, the endothelial mosaic, the flare and large floaters in the aqueous, and presentation of vitreous after cataract extraction can be studied.

Recent ophthalmoscopes. The recent improvements of the lighting in the newer ophthalmoscopes tend to destroy the usefulness of the illuminating system as applied to pocket-slitlamp work. For one

thing, the newer bulb has a spiral filament. Also, the U-shaped filament is threatened with becoming obsolete and unobtainable. The relatively small demand for it is an index of its present general appraisal and the writer believes that it is entitled to a much greater popularity.

The present method of illuminating the numerals on the revolving lens disc is accomplished at the expense of a rather large defect in the side of the condensing lens cap. From the point of view of the linear-streak lamp, too much scattered light escapes, greatly diminishing its effectiveness. The advantages of seeing the numerals does not compensate for this loss of a two-in-one instrument, since it would be necessary to have an additional one.

Conclusions

Simply by removing the head of the ophthalmoscope, every ophthalmologist can have at his command another instrument for focal illumination. If the bulb is of the inverted U type, single filament, and if the lens cap is properly adjusted, he now holds in his hand a linear-streak lamp. After acquiring some steadiness of illumination and experience in observation, he will be able to see through magnifiers much of what is thought to be visible only with the slitlamp microscope. Of course, the linear-streak lamp cannot compete with the standard slitlamp microscope, but the surgeon will be gratified for the considerable information he can obtain when the large instrument is not available.

2 East Ninety-fifth Street.

REGRESSIVE MYOPIA DUE TO RETROBULBAR TUMOR*

A case report

Solomon S. Brav, M.D., and Aaron Brav, M.D.
Philadelphia

Despite the fact that textbooks of ophthalmology state that increase in hyperopia can be caused by a mass pressing forward from the back of the globe, there are comparatively few reports in the literature concerning this phenomenon.

Unilateral exophthalmos is by no means an uncommon condition. One of the many causes of such a proptosis is a retrobulbar mass. In some of these cases, if the mass is of sufficient size and is located within the muscle cone, a marked change in refraction may be noted.

It is essential therefore, in all cases of unilateral exophthalmos, as an aid in diagnosis, to determine the refractive error of the proptosed eye, comparing it preferably, wherever possible, with a previous refraction, or at least with the refractive state of the unproptosed eye.

Sporadic cases of marked refractive change in a proptosed eye have been reported in the literature from time to time. The majority of these cases however, have been accompanied by choked discs, engorgement of vessels, hemorrhages, and the like.

We report this case of marked regression in myopia because of its unusual nature and to stress the importance of refractive changes in the differential diagnosis of unilateral exophthalmos. We believe that such cases can be easily overlooked by both the physician and ophthalmologist, who are concerned with the more serious nature of the condition and

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* From the Ophthalmological Service of Dr. Aaron Brav, Northern Liberties Hospital.

consequently fail to investigate such an apparently unimportant factor as the state of refraction.

The patient, now deceased, was a white male, aged 20 years, first admitted to the Northern Liberties Hospital on July 24, 1940. Prior to that time, his chief complaint was severe epigastric pain after meals. When treatment with alkalies afforded no relief and the patient suffered a massive hematuria, he was admitted to the hospital for study. During his week of hospitalization, he complained of some blurring of vision in the right eye, but external and ophthalmoscopic examinations were both negative. Physical examination at that time showed among other features irrelevant to the ocular condition, a small nodule on the anterior chest wall. This was removed for biopsy. The patient was discharged before the microscopic section was completed, but returned in less than a week because of continuous nausea and vomiting and marked malaise. Physical examination at this time revealed many enlarged lymph nodes, especially the cervical chain, and numerous small nontender nodules on the back and chest. At this time the patient gave a history, previously not mentioned, of having had a small mole removed from his left forearm about one year before the onset of symptoms. A lymph node was therefore removed for biopsy, and a diagnosis of malignant melanoma was confirmed by both microscopic sections. X-ray studies of the lung and skull likewise showed evidence of multiple metastases. The X-ray study of the skull particularly showed a suspicious area in the middle cerebral fossa directly behind the right orbit.

During the patient's second admission he again complained of blurring of vision. Examination at this time revealed a minor degree of exophthalmos of the right eye, with some loss of muscle motion laterally and up and out. The patient also noted diplopia on gazing in those directions. All other muscle motions were normal. A small reddish episcleral mass was seen near the external canthus, into which ran numerous dilated episcleral veins. The pupils were equal and reacted well to light and accommodation. Both corneae were normal.

Fundus examination under homatropine mydriasis revealed clear media and an essentially normal disc, although the veins were somewhat dilated and tortuous. The arteries were slightly narrowed but showed no major changes. No hemorrhages were noted, but there was a series of striae, white in color, which emanated from the macular region, rising and falling in an arc and converging to the disc margin. These lines corresponded essentially to the outline of the arcuate fibers as we know them to exist. The left eye was normal.

At the time of examination it was noted that in order to obtain a clear fundus view in the left eye it was necessary to use −5-D. lens, while in the right eye a clear picture was visualized with a +1-D. lens. The patient's spectacles showed a compound myopic astigmatism of approximately −3.50 D. sph. ⌯ −1.00 D. cyl. in each eye. Retinoscopic examination under full cycloplegia revealed that this was correct for the left eye, but that the right eye was now hyperopic to the extent of about 1 D. As the last previous refraction had been performed at Wills Eye Hospital and a check revealed the glasses to have been ground as ordered, we assumed that we were dealing with a marked regressive myopia. We therefore concluded that the patient was suffering from an orbital, retrobulbar mass that was exerting pressure in the region of the macula, thus inducing an axial shortening of the eyeball with a resultant decrease in myopia. In view of the history

of melanoma we decided that this was an evidence of a metastatic lesion that was located either in the retrobulbar space or was pushing from the middle cerebral fossa into the orbit through the sphenoidal fissure and growing rapidly.

Field examination was impossible, as were any other examinations because of the patient's extremely hazardous condition. About 11 days after his second admission he suddenly became blind (uremic amaurosis), had several convulsions, became unconscious, and died of uremia. Unfortunately, as is too often the case in such interesting problems, autopsy could not be obtained.

There are several interesting features about this case: (1) the rapidity of onset of symptoms; (2) the high refractive change concomitant with a low-grade exophthalmos; (3) the absence of papilledema, and (4) the peculiar type of macular and peripapillary edema noted despite the absence of choked disc.

Samuels[1] stated, as has Stieren,[2] that both the exophthalmos and the increase of hyperopia are of slow onset. This is in direct contrast to the symptoms in our case and we believe is accounted for by the fact that melanomatous metastases are extremely rapid in their growth.

It is difficult to explain the marked regression in myopia with so little exophthalmos. Possibly the position of the mass combined with the rapid demise of the patient accounts for this circumstance. Had the patient survived for a greater length of time, he probably would have shown a considerable increase in the amount of proptosis.

The absence of papilledema is likewise probably explained by similar reasoning. Since the tumor mass was somewhat remote from the nerve head, the region most involved by its pressure, in this case the macular area, bore the brunt of the resulting congestive phenomena. The nerve head, we feel sure, would have shown increasing signs of edema but for the sudden death of the patient. MacMillan and Cone,[3] Neame and Wolff[4] and others have reported cases in which there was marked papilledema, in two of which the refractive change was even greater than it was in our case, but in all instances the choking of the disc was present over a long period of time, and all of these were instances of tumors of the optic nerve.

Most interesting to us were the peculiar striae between the optic nerve and the macula. The only other case with such a concomitant finding was the report of Sitchevska,[5] who referred to them as peculiar lines radiating from the upper pole of the disc. She states that she had difficulty in determining whether these lines were folds in the retina or dilated choroidal vessels. On first glance they appeared to us somewhat to resemble neuroglial fibers. Further examination, however, led us to believe that they were caused by edema along the arcuate fibers or were folds in the retina *per se* or in Bruch's membrane. We have been unable to find a record of a microscopic section of such an eye. Judging from Sitchevska's description of her case it would seem reasonable to assume that, whatever the etiology of these lines the form they take must be due to the position that the tumor mass occupies behind the globe in the muscle cone.

Conclusions

Under circumstances described in our case, changes in refraction towards the hyperopic side constitute a valuable differential diagnostic sign in cases of unilateral exophthalmos.

We conclude that, given a unilateral proptosis associated with a marked change since the last refraction or in the absence of such knowledge a marked ani-

sometropia (sufficient to be noted by the patient), regardless of the presence or absence of papilledema, a diagnosis of retrobulbar mass located in the muscle cone can be made.

This case is reported as an instance in which the myopic regression was high and in which no papilledema was present.

2027 Spruce Street.
5125 Broad Street

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BILATERAL CONJUNCTIVITIS—ACUTE, PNEUMOCOCCIC

J. E. GRAY, M.D.
Iowa City, Iowa

D. J., a white, male, university student, aged 23 years, was referred to the Eye Clinic of the University Hospitals, Iowa City, Iowa, January 1, 1939, by the Department of Student Health for treatment of conjunctivitis.

HISTORY

The patient had noticed redness and soreness of the left eye 20 hours before admission to the Clinic. On the morning of examination, the lids of this eye had been stuck together on awakening and the opposite eye had been slightly red. A few hours before examination, a "sand in the eyes" sensation had developed. He had not contacted knowingly anyone with inflamed eyes the previous week.

PAST OCULAR HISTORY

The vision of both eyes always had been good and he remembered no previous attacks of inflammation or injury to his eyes.

PAST MEDICAL HISTORY

He had had measles when a child but the eyes were unaffected. Otherwise, his health always had been good.

SOCIAL AND FAMILY HISTORY

The patient was a single, white, male, university student who had never had symptoms of venereal disease. No member of the family had complained of eye disease.

GENERAL PHYSICAL EXAMINATION

The patient was a well-developed and well-nourished young adult male with both eyes acutely inflamed. The skin of the face and neck appeared normal. Regional lymphadenitis could not be demonstrated by palpation.

OCULAR EXAMINATION

The vision determined with a Snellen chart was 6/6 in each eye. Inspection

revealed marginal redness of both lids and a moderate diffuse swelling of the left lids. A profuse seropurulent discharge overflowed the lid margins, and flakes of yellowish-white material collected at the inner angles and in the lower cul-de-sac. Eversion of the lids showed the palpebral conjunctiva of the right eye to be diffusely red and that of the left eye to be intensely red and edematous. There was also bright-red injection of the bulbar conjunctiva, more intense in the region of the fornices and fading toward the limbus. A few small subconjunctival hemorrhages were present a short distance from the limbus of the left eye but none were seen in the right eye. Digital pressure over each lacrimal sac did not produce regurgitation from the puncta nor was there any obstruction to the free flow of irrigating fluid through the lacrimal passages. Tenderness could not be elicited by pressure on the ciliary bodies, and the intraocular tension was not increased to palpation. On gross examination the corneae were clear, the anterior chambers of average depth, and the irides appeared healthy. The pupils were round, 3 mm. in diameter, and reacted promptly to light and in accommodation-convergence.

A drop of the sodium salt of fluorescein, 2-percent aqueous solution, was instilled into each eye so that it flowed down over each cornea, and the excess dye was washed out with mercurophen, 1:8,000 aqueous solution. Examination with the slitlamp biomicroscope did not reveal any retention of the green stain in the corneal epithelium, and it was assumed that this membrane was intact. Further examination with this instrument showed no abnormalities of the cornea, anterior chamber, iris, lens, or anterior vitreous of either eye. Ophthalmoscopic examination of the fundi after dilatation of the pupils with eupthalmin hydrochloride, 5-percent aqueous solution, revealed no pathology.

LABORATORY DATA

Cultures, smears, and epithelial scrapings were taken from the conjunctiva at the beginning of the external examination.

CULTURE TECHNIQUE

A flamed platinum loop was drawn over the exposed conjunctiva of the lower cul-de-sac of the right eye, then lightly streaked on one half of a blood-agar plate. The loop was re-flamed and the procedure repeated on the left with the remaining half of the culture plate receiving the inoculum. Thus any bacterial growth could be studied separately for each eye. The plate was incubated at 37°C. for 48 hours, but was examined first at 24 hours, when there were many pin-point colonies each surrounded by a narrow zone of alpha hemolysis. These were in areas inoculated from each eye. At 48 hours, the colonies were small, clear, flat, with a central area of umbilication and surrounded by a slightly wider zone of alpha hemolysis. A tentative diagnosis of Diplococcus pneumoniae was made from the colony morphology. Subcultures of these organisms were soluble in bile, fermented inulin, did not form chains when grown in meat infusion broth, and were agglutinated by type-VII pneumococcus antiserum.

SECRETION SMEAR TECHNIQUE

A small amount of purulent discharge was taken from the lower cul-de-sac with a flamed platinum loop and spread in thin films on clean glass slides. These specimens were allowed to dry in air, fixed by heat, and then stained by the Hucker modification of the Gram technique. Microscopic examination showed many gram-positive, lancet-shaped diplococci and large numbers of pus cells.

EPITHELIAL SCRAPING TECHNIQUE

The conjunctiva was anesthetized by instillation of three drops of holocain hydrochloride, 1-percent aqueous solution, into the lower cul-de-sac of each eye at three-minute intervals. A small, platinum spatula was flamed, cooled in air, and gently scraped across the everted conjunctiva of the lower lid. The material collected was then spread in thin films on clean glass slides. Specimens from each eye were allowed to dry in air while others from each eye were fixed in acetone-free absolute methyl alcohol for 12 hours. The former preparations were stained by the modified Gram method and the latter by the Giemsa technique. Microscopic examination of these samples showed gram-positive, lancet-shaped diplococci, large numbers of polymorphonuclear leukocytes, and no evidence of inclusion bodies in the epithelial cells.

Diagnosis: Acute conjunctivitis O. U., pneumococcic.

TREATMENT

The conjunctiva of each eye was anesthetized with holocain as described above. The upper lid of the right eye was everted and painted lightly and rapidly with a cotton applicator moistened with silver nitrate, 2-percent aqueous solution, care being taken to avoid contact between the solution and the cornea. The painted area was irrigated immediately with mercurophen, 1:8,000 aqueous solution, to prevent prolonged cauterization and to remove any excess silver nitrate. The remaining three lids and caruncles were treated in a similar manner, and another drop of holocain was instilled into each eye. The eyelids were closed gently for 10 minutes and then the sheets of desquamated epithelial cells were removed from each eye with cotton applicators. The patient was instructed to use cold compresses to each eye for 15 minutes, three times at two-hour intervals, and to return the following day.

PROGRESS EXAMINATION AND THERAPY

The swelling of the lids had subsided by the next day, so the cold compresses were discontinued. There was considerable redness of the conjunctiva and a moderate discharge, but in view of the marked improvement topical application of silver nitrate was not repeated. Silver nitrate, 0.5-percent ophthalmic ointment, was instilled into each lower cul-de-sac twice daily, and on the sixth day the only manifestation of a conjunctivitis was a slight diffuse injection of the lower palpebral conjunctiva. The silver ointment was discontinued and phenyl mercuric nitrate, 1:10,000 aqueous dilution, ordered for home use in each eye three times a day. At the next examination four days later, the conjunctiva appeared normal. Treatment was discontinued and the patient was asked to return only if further trouble ensued. He has not returned.

DISCUSSION

Because of the clinical manifestations, the following etiologic factors were considered: Diplococcus pneumoniae, Streptococcus viridans, Hemophilus influenzae, and Hemophilus conjunctivitidis (Koch-Weeks bacillus). A gonococcus infection was considered unlikely because, after 20 hours' duration of symptoms, a profuse purulent discharge was not present. Hemophilus conjunctivitis was deemed improbable because of its extreme rarity in this locality. The pneumococcus was considered mose likely because of its frequency although Streptococcus viridans and Hemophilus influenzae may produce similar clinical manifestations.

The clinical deductions were verified

by laboratory examinations. A Gram stain, made before treatment was instituted, revealed the presence of gram-positive lancet-shaped diplococci, thus eliminating the hemophilus and neisserian groups of organisms, which are gram-positive. The presumptive diagnosis of pneumococcus infection was substantiated by cultures on the basis of colony morphology, bile solubility, and reaction with type specific antiserum indicating that the organism was type VII pneumococcus.

This was one of a series of cases treated with silver nitrate for contrast with another series treated with optochin.

SUMMARY

D. J., a white, male, university student, aged 23 years, was referred to the Eye Clinic for treatment of his eyes. Examination revealed a typical acute pneumococcic conjunctivitis by clinical and laboratory study. The infection reacted favorably to topical application of 2-percent silver-nitrate aqueous solution and instillation of 0.5-percent silver-nitrate ophthalmic ointment. Phenyl mercuric nitrate 1:10,000 dilution, aqueous solution, was employed for a few days after the acute inflammation had subsided. The patient was discharged after 10 days of treatment.

SOCIETY PROCEEDINGS

EDITED BY DR. RALPH H. MILLER

CHICAGO OPHTHALMOLOGICAL SOCIETY

October 21, 1940

RICHARD C. GAMBLE, *president*

CLINICAL MEETING

(Presented by the Department of Ophthalmology, University of Illinois)

HEMORRHAGE IN THE LEFT MACULAR REGION

DR. MARTHA RUBIN FOLK said that K. E., a white woman, aged 26 years, entered the hospital on October 14, 1940, complaining of blurring of the vision of the left eye, which came on suddenly following injection of malarial blood. In August, 1940, she had had treatment for paresis and was then referred to Research Hospital where the first injection, 5 c.c. of malarial blood, was given on September 10th. The temperature reached 105°F., and from that date until October 1st she had chills and fever. Hemorrhage in the left eye occurred one week following injection. The blood count had been normal but a secondary anemia was found after the treatment. Blood and spinal Wassermann tests gave a 4+ reaction.

Vision R.E. = 1.5; L.E. = 0.3. Ocular movements were normal. The irides were blue. Pupils reacted to light and accommodation. The macular region of the left eye showed a round hemorrhage one third the size of the disc. The central fields showed a small scotoma.

Collins and Mayo state that retinal hemorrhages of two types are found in connection with malaria, small peripheral ones which occur during the time the temperature is elevated, and large central ones associated with cachexia of malignant malaria; and that they are doubtless due to thrombosis caused by the parasites.

FOSTER-KENNEDY SYNDROME

DR. MARTHA RUBIN FOLK presented E. P., a white woman, aged 63 years, who had been referred from the Neuropsychiatric Clinic. She gave a history of head injury 10 years ago, at which time she suffered loss of vision for half an hour, followed by vomiting. Several years ago she began to have convulsions at night, lasting a moment or two and preceded by nausea. She suffered from visual hallucinations and had had periods of confusion during the past six months. Diagnosis of brain tumor had been made at the Mayo Clinic; operation was refused.

Vision, R.E., counted fingers at 5 inches; L.E. = 0.2, with correction = 0.6 + 2. Conjugate movement upward did not bring the right eye above midline, but the left eye moved normally. The right eye did not converge for near. The pupil of the right eye was 4 mm. in diameter, reacted to light and accommodation sluggishly; the pupil of the left eye was 3 mm. in diameter and reacted to light and accommodation. The disc of the right eye was pale, margins clearly outlined; the disc of the left eye was hyperemic, elevated, with indistinct margins, and there was general haziness of the retina and some narrowing of retinal arteries. The visual field of the right eye could not be taken; that of the left eye showed concentric contraction of 30 degrees. The tension was normal.

Physical and laboratory examinations gave negative findings except for secondary anemia. X-ray films of the skull showed no pathology. Encephalogram showed in the postero-lateral view, some

air adjacent to the falx. Diagnosis of tumor was made, and operation was performed on August 14, 1940. A large amount of xanthochromatic fluid covered the entire area of the cortex and was aspirated. The frontal cortex showed some convolutional atrophy. Clear fluid was aspirated from the right ventricle. No tumor was found.

Final diagnosis: Right cerebral hydroma and right cerebral atrophy.

Melanoma or melano-epithelioma

Dr. Hallard Beard presented M. G., a woman, aged 62 years, first seen on May 28, 1940. She stated that she had had poor vision in the right eye since childhood, but that it had become worse in the preceding two weeks.

Examination showed vision R.E. to be 8/200, not improved by correction; vision L.E. was normal with correction for hyperopic astigmatism. The fundus of the right eye showed temporal conus and pigment thinning in the central area. Two weeks later a low detachment was noted in the lower portion of the eye, and also a large patch of dark pigment in the superior temporal quadrant, well forward. The detachment continued to rise in spite of complete bed rest. On July 11th a dense shadow was seen on transillumination of the lower and temporal regions.

The right eye was enucleated on July 19th. Sections of the bulb horizontally showed changes in the nerve head and central retina, rather characteristic of myopia. A high bullous detachment of the retina was seen on the nasal side from a point near the papilla to the ora serrata. The underlying pigment epithelium, normal near the disc, was almost uniformly thickened throughout the rest of its temporal extent; in the region of the ora and in the pars planum of the ciliary body it was regularly hyperplastic, showing fusiform enlargement with a number of fingerlike extensions outward. The hexagonal pigment cells, although abnormally large and well defined, showed no tendency to irregularity of form in outline or nucleus.

Further studies will be necessary, but at this time the tumor appeared to be a primary neoplasm arising from the pigmented epithelium of the retina.

Morgagnian cataract

Dr. J. W. Clark said that E. W., a man, aged 68 years, complained of having been blind in the right eye for 35 years. Four weeks previously he awakened with total loss of vision in the left eye.

On examination the external findings were negative. Vision R.E., light perception; L.E., 0.3−1. The lens of the right eye had a fluid cortex with dense reddish-brown nucleus which floated back and forth in the lens. In the fundus of the left eye the vessels were sclerotic. Many scattered petechial hemorrhages were seen throughout the retina, more on the temporal side. One small hemorrhage was found in the macular region. The lower half of the retina was pale, and through it the choroidal circulation could be seen.

Diagnosis: Morgagnian cataract, sclerotic retinal vessels, petechial retinal hemorrhages, and retinitis.

Occlusion of the central retinal artery

Dr. J. W. Clark presented M. W., a woman, aged 48 years, who complained of sudden loss of vision in the left eye. Examination showed vision R.E. 0.8−1; L.E., light perception. Externally the left eye was normal. The central retinal vessels were markedly constricted, especially the arteries and branches. The disc was pale, and the margins were recognized only by the depth of cupping of the disc. The entire retina showed varying degrees

of whiteness. The macular region was sharply defined by a black ring, open on the nasal side, about one-eighth disc diameter, and was cherry red in the center.

On October 15th, a 1-percent novocaine injection of the stellate ganglion, on the left side of the neck, was made by Dr. DeTakats. Within 15 minutes there was definite elevation of the surface temperature of the left side of the face, neck, arm, and hand. There was no alteration in the vascular supply to the conjunctiva, nor evidence of Horner's syndrome. The caliber of the retinal vessels was not altered; the optic disc was definitely outlined except for a sector extending outward from the temporal side of the disc. The retina seemed less pale, with a reddish hue not present on previous examination. The yellowish color of the macula was plainly visible at the end of one hour. No further change occurred.

Case of malingering

Dr. Carl Apple said that E. S., a white woman, aged 24 years, was first seen at Research Hospital on May 20, 1940, with complaint of inflamed eyes and dilated pupils, and constant headaches of three months' duration. She had been discharged from Billings Memorial Hospital six months prior to this time.

Examination revealed all conjunctival surfaces of both eyes superficially injected. The pupils were dilated to 9 mm. and did not react to light or accommodation. Vision R.E. was 0.1; L.E., 15/200. A symblepharon was present between the lower lid of the right eye and the bulb. The tension was normal. The fields showed concentric contraction of 10 to 15 degrees for form and red. Slitlamp examination and refraction under homatropine gave no further information.

All laboratory studies made at this time and reported from Billings Hospital were negative. Neurologic examination was negative. Biopsy of the right lower fornix was suggestive of Parinaud's syndrome. Three typhoid injections and a course of sulfanilamide had been given.

On October 7th, the patient was admitted to neurosurgery for an encephalogram, at which time she was observed by a psychiatrist who discovered psychotic tendencies. A bottle of homatropine was found in her purse, whereupon she went into a hysterical state and threatened suicide. She was placed in the psychiatric hospital for several days and then discharged.

Congenital opacities of cornea and lens

Dr. E. J. Horick presented a high-school boy attending sight-saving classes. In both eyes the vision was 8/200. Both eyes showed aniridia, corneal and lenticular opacities, rotary nystagmus, alternating convergent strabismus, threadlike vitreous opacities, and imperfect development of the maculae. Vision was not improved with glasses.

The lids were normal, the eyes were of normal size and shape. There were 25 degrees of alternating convergent strabismus. The constant nystagmus was rotary, with slow movement to the right and quick return. External eye movements were normal. The corneae were of normal size and shape, clear except for a few maculae near the limbus. The anterior chambers were clear and deep. No iris was visible in either eye. The lenses were in good position and presented in the peripheral portions long circumscribed gray opacities, lying forward anteriorly and peripherally and extending back behind the nucleus. There was no peripheral clear portion of the lens. The space between the sharply defined lens border and ciliary body was clear and the zonular fibers could be seen.

The red reflex was good and in the con-

stantly moving eye a threadlike vitreous opacity moved slightly behind the central part of the lens, probably a remnant of the hyaloid artery. The fundi were normal, the disc and vessels were fairly clearly seen. Fields and color sense were normal. The poor vision was apparently due to faulty development of the macula.

Scientific program

Subdural hematoma and retinal hemorrhage

Dr. Douglas N. Buchanan presented a paper on this subject.

Choked discs in lead encephalopathy

Dr. Palmer Good presented a paper on this subject which was published in this Journal (July, 1941).

Neuroblastoma of adrenal gland with orbital metastasis

Dr. George Guibor read a paper on this subject which will be published in this Journal.

Marble bones and optic atrophy

Dr. Roy O. Riser presented a paper on this subject which was published in this Journal (August, 1941).

Ocular hypertelorism of Greig

Dr. Elmer Vorisek presented a paper on this subject which was published in this Journal (August, 1941).

Discussion. Dr. Joseph Brennemann felt that he had been asked to discuss these papers because he had a parental relationship to these young men. Also, from the pediatric standpoint and possibly a broader clinical view, something might be said that would be of help to the ophthalmologist in orienting certain pathologic conditions.

With reference to subdural hematoma, he felt even more confused than Dr. Buchanan in considering the etiology and pathogenesis. Following the original work of Virchow and later that of Finkelstein and Rosenberg, this condition was spoken of as pachymeningitis hemorrhagica, although there was no evidence that it was really of an inflammatory nature. It had some of the aspects almost of a neoplasm. More recently it has been spoken of as subdural hematoma; and yet that leaves one somewhat unsatisfied. There are probably five to six skull fractures with probable hemorrhages in Children's Memorial Hospital at all times, and in no instance had he known of one that looked like the so-called subdural hematoma. In the cases he had seen there was no history of trauma. It is interesting and peculiar that it occurs so frequently on both sides. Furthermore, the large number of cases reported by Finkelstein and Rosenberg from the Kinderasyl in Berlin were practically all in babies, and inasmuch as they occurred in the institution one can hardly assume that trauma was an etiologic factor. Nearly all he had seen occurred in babies. The striking thing in early infancy is the evidence of increased intracranial pressure, shown by the obvious headache and more strikingly by the bulging fontanel. There are often convulsions. There may or may not be a papilledema, depending upon how advanced the condition is or to what extent the sutures are closed. An important point is the common finding of retinal hemorrhage. Lumbar puncture is of little significance except that pressure is likely to be increased; therefore, the same precautions should be taken that would be observed in the presence of any suspected intracranial tumor. The diagnosis is established by finding a bloody or xanthochromatic fluid following bilateral subdural puncture. A tumor could hardly be expected at that age nor would there be retinal hemorrhages. An ordinary idio-

pathic hydrocephalus dates practically from birth and can easily be excluded by subdural puncture.

As Dr. Buchanan said, the prognosis is not especially good. In the series of about 50 cases reported by Finkelstein and Rosenberg, a certain number of the patients were operated upon. The result was so poor that the physicians decided operation was of no avail. The prognosis with operation is apparently somewhat better, and yet with a mortality of 30 percent and a questionable future as to sequelae, one can only say that the condition is very serious. Infection occasionally occurs, and in two reported cases death followed. On the other hand, in a case reported by Dr. Clifton and Miss Werner, in which apparently subsequent to a subdural hematoma an abscess was found on each side with 32,000 cells in the fluid, there was apparently complete recovery after simple bilateral incision and drainage.

The ophthalmologist is interested in lead encephalitis because of the possibility of lead encephalitis and choked disc. The pediatrician is interested prior to the onset of these conditions, because the prognosis is rather directly proportionately favorable to the time diagnosis is made and proper treatment instituted. Lead can enter the system by mouth or by way of the respiratory tract. The symptoms in children differ widely from those in the adult, in whom one thinks of lead colic, wrist drop, and other manifestations of neuritis that are extremely rare in the child. The early symptoms are usually headache, vomiting, possibly anemia, and probably abdominal pain. Stippling of the red blood corpuscles is not constant. When encephalitis occurs the neurologic symptoms are found, associated with choked disc or atrophy of the optic nerve, and the condition may then closely resemble a cerebellar tumor. In one child aged 5 or 6 years, the diagnosis of midline cerebellar tumor was confirmed by the brain surgeon. He had staggering gait, Romberg sign, general incoördination, absent reflexes, and choked discs. When no tumor was found at operation, the suggestion was made that the condition might be due to lead poisoning, and this was found to be correct. In every case in which a child vomits persistently or has a choked disc, evidence of lead poisoning is sought. The important points are the history and the dense shadow shown in the X-ray study at the metaphyseal line. It must be remembered, however, that calcium and certain of the heavy metals make an almost equally dense line. The line in the gums is of relatively little diagnostic value. Early treatment seemed logically to be some form of "de-leading," by producing acidosis. Unfortunately, this released lead poured into the circulation reached the brain, and often made a present encephalitis worse. The treatment now is to give calcium and vitamin D, because mobilization of calcium and lead shows much the same pattern and one can tie the lead down and let it work out of the circulation gradually in the course of time. The prognosis in early cases is good; with advanced encephalitis it is not so good. Death may occur due to this condition, and if the child survives there may be serious neurologic sequelae.

The case of marble bones described was the only one Dr. Brennemann had seen. The condition is rare. He had seen one case that looked much like it superficially, with optic atrophy and marked density of the bones, but the X-ray picture was rather strikingly different.

Dr. Willie Mae Clifton referred to the X-ray films shown, and said that even at the time of the last picture, taken three or four years after the onset of lead poisoning, the child still showed the in-

creased density at the metaphyses. In marble bones there is a striking difference. Calcium continues to be laid down, but there is an impaired ability or inability to withdraw it from the bones, so that the first line shown at 10 weeks remained, and as the bone grew in length this line receded from the epiphyses and other lines formed. This abnormal growth forms the basis for the present thinking that there is some developmental disturbance in the ability to form bone of normal structure.

Marble bones are very dense and brittle in the sense that they do not stand a shearing force well; hence, the pathologic fractures. Transverse fractures occur more readily at the lines of lesser density. Children who have marble bones at birth have the severe, more rapidly progressive form, and usually do not live beyond adolescence. The bone encroaches on the marrow to give an anemia. If the patient does not succumb to this alone, an intercurrent infection may hasten exitus. Leukemia as a final development is prophesied for those who survive the other complications.

Marble bones is the only benign bone disturbance that leads to narrowing of foramina by the elaboration of excess osteoid. When the narrowing of the optic foramen is sufficiently marked, pressure on the optic nerves supposedly leads to blindness.

Dr. Robert H. Good said with reference to Dr. Buchanan's paper that probably prior to the time he saw the patient the hemorrhage was between the dura and the skull. The patient was not restless, whereas, had the hemorrhage been in the arachnoid, he would have been. Furthermore, the serosanguineous fluid came out before the dural was opened.

He referred to an article he had published in 1920* on symptoms of irritation of the dura. The conditions that may irritate the dura are hematoma, cysts, abscesses, and toxic absorption. There are even extradural irritations from the mastoid when there is necrosis and destruction of the membrane in the mastoid, which allows the toxin to travel through and irritate the dura. This produces swelling of the dura, and all nerves and blood vessels passing out of the skull through the foramina are covered with dura. A choked disc and hemorrhage of the retina occur because the veins leading from the eyeball become constricted and the retina becomes congested, and as the dura becomes more edematous choked disc occurs. When the otologist finds a suppurating ear and paralysis of the external-rectus muscle, he thinks there is an abscess or infection in the tip of the petrous portion of the mastoid bone, which is not necessarily so. The mastoid can produce paralysis of the external rectus by toxins absorbed by the dura. The symptoms of extradural or dural irritation are easy to diagnose. The pain is always in the same place; there is frequently vomiting or nausea. The temperature, respiration, and pulse should be recorded every three hours. Once or twice a day, in all cases of edema of the dura, there will be found subnormal temperature, slow pulse, and slow respiration. This is always more marked in a febrile case.

Dr. Douglas N. Buchanan said that in the cases under discussion the dura was intact. Round-cell infiltration has never been demonstrated in the study of the dura.

Dr. Sanford Gifford asked what the bone pathology was in fragilitas ossium associated with blue sclerae and osteosclerosis, and how it differs from that in marble bones.

Dr. Willie Mae Clifton, in answer to

* Laryngoscope, 1920, Nov.

Dr. Gifford, said that the chief difference between osteosclerosis and fragilitas ossium is that in osteosclerosis there is dense bone with thick cortex encroaching on the marrow; in fragilitas ossium there is a very thin cortex with large medullary space containing relatively little calcified material. The cortex is so thin that in the X-ray study one can outline the medullary space. The bones in fragilitas ossium crush very easily. The two conditions have in common that both are congenital and familial.

Dr. Joseph Brennemann, with reference to Dr. Gifford's question, said that probably 20 blue sclerae that are a simple familial occurrence are seen to one that is associated with fragilitas ossium. The relationship between blue sclerae and fragilitas ossium is unknown, but one could always have recourse to the statement of a German observer that the condition probably originated in the anlage.

Dr. Roy O. Riser said that in the case reported by Laurell and Wallgren, to which they gave the name of osteosclerosis fragilis generalisata, there was subsiding papilledema and optic atrophy. They did not mention blue sclerae.

Robert von der Heydt.

COLORADO OPHTHALMOLOGICAL SOCIETY

October 19, 1940

Dr. William M. Bane, *presiding*

Intraocular hemorrhage

Dr. J. M. Lamme presented the case of J. R., aged 32 years, who suddenly went blind in the left eye, following the exertion of lifting a heavy door. There was a history of previous injury to the head during a fainting spell while having a blood test. The eyelids, conjunctiva, iris, and reflexes of both eyes were normal. Vision of the right eye was 20/20; of the left eye was 20/200. The media and fundus of the right eye were normal. A massive hemorrhage accompanied by a large retinal tear was present in the lower nasal quadrant of the left eye.

Disciform keratitis

Dr. G. H. Stine presented the case of M. G., aged 70 years, who first consulted the doctor on August 20, 1940, complaining of blurring of vision and redness of the right eye and giving a history of a lime burn of the left eye when a child. There was found on examination a typical disciform keratitis of the right eye with a circular area of edema of the cornea, folds in Descemet's membrane, but no definite infiltration or staining of the epithelium. Smears from the eye showed pneumococci. No focus of infection was found during routine physical examination. The condition improved slowly under treatment until the epithelium broke down; this was followed by infiltration and rapid involvement of entire cornea, resulting in a ring abscess. The treatment consisted of giving such sulfonamide drugs as sulfapyridine, sulfanilamide, and sulfathiazole; also instillation of atropine and a paracentesis of the cornea. The condition at the time of the report was controlled, and healing had begun with progressive clearing of the cornea.

Multiple intra- and extraocular foreign bodies

Dr. G. H. Stine presented a second case, that of J. H., aged 27 years, who was in a dynamite blast on November 17, 1939. A large number of foreign bodies were embedded superficially and deeply in the cornea and bulbar conjunctiva of both eyes. Many of these were removed. A perforating injury to the left eye at the nasal limbus resulted in a hemorrhage

in the vitreous and a prolapse of the iris, which was repaired by an iridectomy and a conjunctival flap. A few particles of rock had penetrated the right eye, coming to rest on the iris and probably in the lens, which was cataractous. The cataract was needled on May 14, 1940, and was said to be slowly absorbing. There was no inflammatory reaction around any of the remaining foreign bodies. The left eye was quiet, but a dense white globular mass, in which glistening foreign particles could be seen, was present in the nasal periphery of the fundus. This was interpreted to be due to organization of hemorrhage and granulation tissue.

Ophthalmia neonatorum

Dr. F. Nelson presented the case of E. L. G., an infant, aged three days, a typical case of unilateral gonorrhea neonatorum. The condition started the first day after birth with smears showing intracellular gonococci. The cornea was still in good condition. The treatment was limited to the administration of 5 grains of sulfanilamide daily, distributed over 24 hours in portions of one grain each dose. No local treatment was instituted. By mistake the baby received the entire daily dose of 5 grains within 9 hours instead of 24. Serious asphyxia and cyanosis resulted, from which recovery was aided by use of lobelin and the oxygen-carbon-dioxide mixture. The gonorrheal condition was healed both clinically and bacteriologically within 10 hours.

Tuberculosis of the eye

Dr. F. Nelson presented a second case, that of J. M., aged 35 years, who had recurrent hemorrhages in the vitreous bodies of both eyes from a tuberculous periphlebitis. The patient was blind in both eyes except for light perception. Treatment consisted of hospitalization and bed rest for six months and resulted in complete recovery.

Dynamite-cap explosion involving both eyes

Dr. V. H. Brobeck presented the case of M. B., aged 11 years, who was injured by the explosion of a dynamite cap on June 19, 1940. When he was first seen, one hour following his injury, the distal phalanx of thumb, middle, and ring fingers of his right hand were destroyed. The upper two thirds of his face was the site of countless small perforating abrasions and punctured lesions. The anterior chamber of the right eye showed considerable hyphemia. Two small lesions, one on the cornea and one on the episcleral region below the level of the insertion of the internal-rectus muscle of the right eye, were quite probably points of entry of the perforating foreign bodies. After clearing occurred in this eye a fairly large glistening foreign body was observed in the lower nasal anterior segment with a large area of chorioretinal damage beneath. In the left eye the lens soon became cataractous following its perforation by a metallic fragment. After a period of six weeks the synechiae in this eye were freed after a keratome incision was made at the 3-o'clock position, the lens was "puddled," and the anterior chamber irrigated with saline, resulting in the recovery of a 0.5 x 1 mm. foreign body. On the date of this report the right eye, containing the copper in the vitreous, was quiet and the visual acuity was 0.8. It had not shown signs of irritation since the first inflammatory reaction subsided. The vision in the left (aphakic) eye was 0.8 with $+11.50$ D. sph. $\bigcirc\!\!\!\!\bigcirc$ $+4.50$ D. cyl. ax. 45° with a $+3.00$ addition for near. He had elected to use the aphakic eye in school and was "carrying on" with

his classmates, rating a "B" average. Many consultants in the Middle West had agreed to forego intervention in the right eye but advised frequent inspection.

A PROGRESSIVE SUPERFICIAL CORNEAL HAZE FOLLOWING CATARACT EXTRACTION

DR. W. M. BANE reported the case of N. A., aged 60 years, who had had loss of vision in his right eye for 11 years and a progressive loss of vision in his left eye for 6 years. Vision was recorded as the ability to see hand movements with the right eye, and 3/60 in the left eye. Externally the right eye appeared normal, but the vitreous contained floaters, and there was a large area of central retinochoroiditis. External examination of the left eye was normal. A central nuclear lens opacity was present in the left eye. Surgery was advised, and an extracapsular operation was performed on August 7, 1940. Considerable cortex remained but slowly disappeared. On September 10, 1940, a superficial keratitis appeared on the center of the cornea. This was treated by denuding the area with syrup of iodine, paracentesis of the cornea, X-ray therapy, and administration of vitamin A. The superficial staining of the keratitic area cleared up, but a central opacity remained.

Harry W. Shankel,
Secretary.

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WAR

The Journal pledges itself to the service of our country. It stands ready to assist in any way possible. Scientific work must go on and must have an outlet by which advances in our knowledge can be made effective everywhere. Medical officers in the field, hospitals, and laboratories must be given the opportunity of receiving the flow of ideas. It is more important now than ever before that the lamp of scientific progress be kept burning. The Journal is determined to do its part.

Derrick Vail.

OPHTHALMOLOGIC JOURNALISM IN BRAZIL

A few months ago, Brazil, largest, most populous, and wealthiest of the republics of South America, held its Fourth Congress of Ophthalmology. Dr. Harry S. Gradle, who at Cleveland in 1940 had been elected president of the newly organized Pan-American Congress, flew down to Rio de Janeiro to attend the Fourth Brazilian Congress, and three other American ophthalmologists appeared on the program by communications read "in absentia."

Concerning Brazil, with its five or six million square miles of territory and its population of between forty and fifty million, we are apt to think chiefly in terms of the Amazonian jungle, where rank vegetation, tropical diseases, and poisonous forms of animal life are pictured as offering almost insuperable obstacles to the advance of civilization. But about one half of the area of Brazil is rendered healthful by altitudes well above sea level, and these more healthful areas are occupied principally by immigrants, or descendants of immigrants, from several European countries, particularly Portugal, Italy, and Germany. The Indian tribes and the offspring of the twelve million Negroes imported from Africa before the discontinuance of the slave industry, in 1853, reside for the most part in the tropical lowlands of the north.

Medical science is so essentially a part of modern civilization that one might estimate the cultural level of a nation by the character of its medical journals. Unfortunately, the path of medical journalism as it applies to the specialties has often been a thorny one. This is particularly true of small countries, or of countries whose population is of such a character as to furnish a number of subscribers inadequate for sustaining the expense of handling, printing, and publishing. Special medical journalism has too frequently had to struggle for existence, sometimes living a short life and dying of inanition.

In Brazil the past few years have seen a number of ventures in ophthalmic journalism. An apparently vigorous journalistic youngster, under the title of "Annaes de Oculistica do Rio de Janiero," and sponsored by Abreu Fialho and his son ten years or so ago, discontinued publication after a single year and has not been heard from since. In 1933 a group of ophthalmologists of the city of São Paulo, in the Brazilian state of that name, established the Revista de Oftalmologia de S. Paulo, which was the official organ of the Ophthalmological Society of São Paulo. This journal, after being published for six years in quarterly parts, has for the past three years failed to reach the editors of the American Journal of Ophthalmology, and may therefore be presumed to have passed out of existence. Its articles were for the most part very brief, but sometimes of high scientific quality.

It is possible that the Revista de Oftalmologia de S. Paulo was succeeded by Ophthalmologia Ibero Americana, also a quarterly and now in its third year. This excellent little journal carries the names of F. Belgeri, President-treasurer, of Buenos Aires, and Moacyr E. Alvaro, Director Founder, of São Paulo, all editorial correspondence being directed to the latter; and in addition the names of Renato de Toledo, Manoel A. Silva, Arthur Amaral, and Raul Chamma, as editorial secretaries.

Ophthalmologia Ibero Americana is printed partly in Spanish (Castilian), partly in Portuguese, according to the idiom of its collaborators. Particularly of late, Portuguese has predominated, perhaps on account of some practical difficulties in coördination of efforts from the different South American countries. It is the custom of this publication to include each quarter a single original article, and a comprehensive series of abstracts from the world's periodical literature of ophthalmology.

The latest issue, for example, carries (in Portuguese translation by Alvaro) the paper presented in absentia before the Brazilian Congress by S. Hanford McKee, on ophthalmia neonatorum. The forty-five pages of abstracts in the current issue are for the most part in Portuguese, the remainder in Spanish. Some reports of the proceedings of the Uruguayan

Ophthalmological Society are naturally in Spanish. A group of book reviews and a brief report of the meeting of the Fourth Brazilian Congress of Ophthalmology are in Portuguese.

It is perhaps not indiscreet to mention that the major part of the task of preparing Ophthalmologia Ibero Americana falls on the shoulders of Moacyr E. Alvaro. Our São Paulo colleague has become a regular attendant at the annual meetings of the American Academy of Ophthalmology and Otolaryngology, and in Cleveland, in October, 1940, he (with Conrad Berens) was elected executive secretary of the Pan-American Congress of Ophthalmology. This indefatigable worker has recently translated into Portuguese the sixteenth edition of May's "Manual of the diseases of the eye."

The Medical Association of the Instituto Penido Burnier, apparently a private or endowed eye, ear, nose, and throat clinic at Campinas in the state of São Paulo, issues a handsome quarterly (Arquivos do Instituto Penido Burnier), beautifully printed and illustrated. This publication, now in its seventh year, maintains an exceptionally high level of scientific presentation.

From São Paulo again we receive another excellent publication, a bimonthly, which has just completed its fourth year. This is the Arquivos Brasileiros de Oftalmologia, organ of the (Brazilian) National League for the Prevention of Blindness. Its directors are: W. Belfort Mattos, B. Paula Santos, and Durval Prado. The August, 1941, issue of this publication, the latest available at the time of the writing of the present comment, includes a long article by W. Belfort Mattos on complete and partial results in the operation for detachment of the retina; a paper by Moacyr E. Alvaro and Eleanor Brown Merrill on the prevention of blindness and the conservation of vision (previously published in English in the Sight-Saving Review); and papers respectively on congenital anomalies, protective lenses, individual psychology in primary glaucoma, and voluntary nystagmus. The remainder of the journal is devoted to abstracts and society reports.

The Ophthalmological Society of Minas Gerais, the wealthy mining and industrial state of southern Brazil, has adopted as its official organ a publication entitled "Ophthalmos." This attractive periodical, edited by Hilton Rocha, appears only twice each year. It has completed its third year. Not long ago a 232-page issue of this journal was devoted to a series of papers on strabismus, by Alvaro, Silva, Sverdlick (of Buenos Aires), Semeraro, de Andrade, and Machado.

All in all, the ophthalmic literature of Brazil is impressive in its professional quality. There is one respect in which perhaps our Brazilian colleagues might expand the benefits conferred by their contributions to the literature. It is rather common to find an essay which makes mention of the work of a number of previous writers, but without offering the reader any indication as to where the original sources are to be found. The present writer has already taken the liberty of calling attention to this defect, when reviewing an otherwise excellent book by Cesario de Andrade on tropical ophthalmology. It is rather provoking to attempt to trace literary sources without any indication of time or place.

The ophthalmologists of Brazil are now undertaking the establishment of a "Conselho Brasileiros de Oftalmologia," corresponding to our own twenty-seven-year-old American Board of Ophthalmology, but possessing also some of the attributes of the British Council of Ophthalmology. This new organization is to be constituted of those who teach oph-

thalmology in the medical schools of the country and of the presidents of ophthalmological societies.

The movement toward coördinated action, especially in the establishment of more definite standards for the practice of ophthalmology in Brazil, is likely to indicate the need for some measure of unification in the journalism of the specialty. Competition is healthy and stimulating, but unity also has its advantages. It seems that much could be gained by consolidation of several of the existing eye journals of our South American neighbor.

W. H. Crisp.

REFRESHER COURSES

Returning from the recent meeting of the American College of Surgeons in Boston, a confrère asked how a man living in a comparatively small city who desired to keep himself informed on the latest practices in ophthalmology should proceed. More specifically, he inquired whether such an ophthalmologist would do better to visit clinics or to attend medical meetings. The answer to this seemed fairly easy, for little is to be learned from visits to clinics unless one goes to investigate some particular subject and the host is prepared well in advance for the visit so that he can provide material and make the necessary preliminary plans. I am regretfully aware that the visitors to my own department have not received much that has been very worthwhile. The answer to the specific question, therefore, did not seem difficult, but this opened the field for discussion of the broader question of how may a physician—and there are many of them—who is situated as the one described, best keep in line with modern trends.

Reading of the pertinent current literature is extremely valuable, but it has the important defect that it lacks visualization and critical analysis. The writer is usually enthusiastic about his own ideas, but is often not the best judge of their true value and relative importance. To get this information the student must see and hear and question. An analysis of some of the now available facilities for doing this might be of interest.

To consider first the American College of Surgeons: For many years this meeting offered little to the ophthalmologist. The eye section amounted to little, and few ophthalmologists attended. This, however, is no longer true. The eye section is now well organized and has a broad and interesting program. If the ophthalmologist wishes to spend all of his time in perusal of his specialty only, he can occupy his time from morning through evening profitably, although he might do better to study the program carefully for lectures in fields related to ophthalmology. The unique asset of the College of Surgeons for the visitor is the surgical clinic. Here one may see at each meeting a great variety of surgery, a feature of tremendous advantage to the man from the small town. This is the only large meeting at which such an opportunity is offered. To be sure there are disadvantages in this method; among them the relatively poor surgery occasioned by the stress of the situation and the unsatisfactory view usually obtainable by the visitor. Another difficulty is that there are too many programs on each morning of the Congress which theoretically might divide the ophthalmic group, but actually fail to accomplish this, as one surgeon will invariably draw the crowd and the other surgeons who have spent much time in collecting material and making other preparations will have few or no visitors. Registration and tickets for a definite and limited number of spectators for each demonstration with strict adherence to

this policy of limitation might obviate the difficulty. The rule has long existed but has not often been applied.

In addition to the surgical clinics there are dry clinics which are equally, if not more, instructive. Every morning at the meeting can be occupied with these clinics.

In summary the College of Surgeons offers something unique and of great value to the ophthalmologist. He will feel well repaid for his attendance.

The greatest teacher of them all is the Academy of Ophthalmology and Otolaryngology. There are more rings than a circus, and the only difficulty is to choose. But though there are many interesting features, the outstanding contribution of the Academy is its instruction courses. Nine hours may be spent at each meeting with the best teachers in the country discoursing on every imaginable subject.

The section of the American Medical Association can be counted on to produce a fine program. Here the physician may keep abreast of the progress of general medicine, and meet his friends in all branches. This is an enormous show; 10,000 doctors strong. Main Street comes to Main Street.

The Southern Medical Association is sectional and perhaps should therefore not be mentioned, but its very size entitles it to consideration, and in it good fellowship predominates. Many men, wise in clinical lore, enter the discussions at these meetings, whereas there are only a few who venture to arise without prepared discussions at the national meetings and this is destructive to spontaneity and free expression. The informality is not unlike a town meeting and as such it has a homely worth. No better times are had than at the Southern, but for the ophthalmologist and the otolaryngologist the meetings will not be tops until a separate section for each is established.

Last to be considered are the postgraduate courses, three of which are outstanding: The Los Angeles midwinter course; the George Washington University, and the Rochester courses. Here are opportunites for refresher didactic lectures given by experts. The material is meaty—so much so that there may be overstuffing—but without clinical demonstrations tends to be poorly assimilated and productive of indigestion. The student hears much and goes away satisfied, but when he tries to review and apply the assumed acquisitions they somehow seem for the most part not to have been absorbed. This sounds like damning with faint praise; however, these courses do have great value, are serving an excellent purpose, and are justly popular.

Thus an ophthalmologist has a broad educational field from which to choose and he makes a great mistake if he does not avail himself of the opportunities.

Lawrence T. Post.

GOOD NEIGHBORS

In the last 10 years, in an effort to improve its standards, American ophthalmology has become somewhat self-centered, with the result that little attention has been paid to surrounding conditions. It has been only during the last few years that we have become conscious of our good neighbors in Central and South America and have realized the mutual advantage of a closer coöperation.

This resulted in the founding of the Pan-American Congress of Ophthalmology in 1940 at the time of the meeting of the American Academy of Ophthalmology and Otolaryngology. This meeting was so successful that it was decided to continue the organization, and plans have been made for the second Pan-

American Congress to convene in Montevideo, Uruguay, in 1943.

At the forty-sixth annual meeting of the American Academy of Ophthalmology and Otolaryngology two incidents occurred that further illustrate this growing coöperation.

The ophthalmologists of our sister countries in South America have decided to form boards of ophthalmology in their respective countries in an effort to elevate the standards of education in ophthalmology. Dr. Moacyr E. Alvaro of São Paulo was commissioned to study the methods employed by the American Board of Ophthalmology and make a report of his recommendations. Dr. Alvaro was present during every stage of the examination and was encouraged to observe the methods employed by various examiners in the different subjects. He also was present at the Board deliberations when candidates were discussed and where various problems associated with the Board came up for consideration. It was particularly opportune this year as it was necessary to rewrite the booklet sent to applicants and candidates as well as to revise the application blanks. The facts obtained should help materially in the organization of the South American boards of ophthalmology and should make it possible for them to avoid some of the difficulties the American Board (the first to be formed) encountered, due to lack of experience.

The second noteworthy incident occurred at the business meeting of the American Academy of Ophthalmology and Otolaryngology. This society voted that with the establishment of boards of ophthalmology in South America along the lines and standards of the American specialty boards, diplomates of those boards would become eligible for membership in the Academy.

These two events seem to be another application, from a practical viewpoint, of the Good-Neighbor Policy. It is hoped this is another step toward the better understanding and coöperation of the ophthalmologists of the two continents of the Western Hemisphere.

Frederick C. Cordes.

ZONULA CILIARIS ZINNII

The present issue of the Journal, the first since the entrance of our country into the war, contains several works of the utmost importance. Much pride is taken in presenting them particularly at this time. It is a good omen and signifies that the highest standards of ophthalmic literature will be maintained in spite of "hell and high water."

Particular attention should be given to the papers by Troncoso and Ascher. They may well be milestones on the road of ophthalmic progress, and are valuable contributions.

The history of the anatomical studies of the zonula of Zinn, or the suspensory ligament of the lens, forms an interesting study. Duke-Elder in the first volume of his textbook, published in 1932, outlines this history in some detail. The present generation of English-speaking ophthalmologists, brought up on this admirable textbook, are thoroughly familiar with the modern conception of the anatomy of the zonula. The older generation, suckled by Fuchs's textbook (1924), and even the later (1936) Berens's textbook, will be surprised to learn that the conception of definite and independent fibers has yielded to that of a glass-like membrane.

Johann Gottfried Zinn published in Göttingen in 1755 his book "Descriptio anatomica oculi." In a chapter entitled "Membranula coronae ciliaris, cuius ope lens crystallina cum vitreo coniungitur, et canalis Petitianus," he discussed the

previous studies of Petit (1723) and Winslow (1732) who considered that the zonula was a membranous structure closely related to the vitreous. The hyaloid membrane was divided into two portions in the region of the ciliary body, one layer continuing over the anterior surface of the vitreous, the other forming the zonula. Zinn elaborated on this idea and described the anatomy in such particulars that his name was given to the structure.

When the great interest in histologic studies became manifest in the middle of the eighteenth century, Hannover (1852) described and gave his name to a canal running around the periphery of the lens between the anterior and posterior layers of the suspensory ligament. From this time on a large number of descriptions of the zonula ciliaris appeared. Almost all of these were histologic and more and more attention was devoted to a minute study of the so-called fibers. Gerlach (1880), Czermak (1885), Collins (1890), and particularly Salzmann (1900) spent enormous effort and labor to ascertain the different types and directions of the fibers. Garnier's (1892) classification is classical and is still to be found in textbooks published as late as 1936. In spite of the attempt to give a clear classification of the fibers, much confusion existed. Salzmann recognized this confusion and said "no description is able to give with absolute accuracy any intermediate conception between the regularity and irregularity of the arrangement which characterizes the plan of the whole arrangement and this description then naturally emphasizes the regularity; the other sees only the variations from the rule and for this reason denies any law. The truth lies in the mean between the two extremes."

Even the extensive use of the slitlamp and corneal microscope did not do very much to clarify the issue. Egger (1924) and Beauvieux (1929) became convinced of the membranous nature of the zonula although they did not ignore the fibers, seen so often in favorable cases with the slitlamp.

Duke-Elder in 1930 was among the first to recognize that we had gone astray in our histologic studies and that the older conception as elaborated by Winslow, Petit, and Zinn was the more nearly correct. In his textbook he discusses the present concept as follows "Fibers are present but these are of the same nature as fibrillae of the vitreous body between which is a clear transparent, gel-like substance showing the same physico-chemical properties of the vitreous gel." He explains that the development of the zonula proceeds similarly to that of the vitreous and is an extracellular product of the prolongation of the retinal elements (ciliary epithelium) over the ciliary body.

Troncoso's magnificent studies continue the evolution of our knowledge by an enormous step. Comparative anatomy of this structure particularly has been emphasized. Too strong praise cannot be given for his work.

Those who attended the Academy meeting in Chicago in October, 1941, will recall the two splendid exhibits pertaining to the zonula and its clinical importance. These were given by J. Goldsmith and H. Minsky and were justly awarded proper recognition by the Academy officers. It is to be hoped that all ophthalmologists will have the opportunity of seeing and studying them, because they are further important strides along the path of our knowledge.

It is unnecessary to do more than point out the clinical bearing of this subject. Kirby has described a method of "milking" away the zonula above as an aid to the intracapsular extraction of cataract. This will be published in a forthcoming number of the Journal. McReynolds accomplished probably the same result by

his maneuver of making the cornea more vertical by forceps traction above and below. The Smith pressure over different parts of the lens periphery below is a well-known step in the operation.

More complete knowledge of the zonula will explain many of our problems pertaining to the embryological defects as well as assisting us to perform better and more logical cataract and even glaucoma operations.

Derrick Vail.

BOOK NOTICES

OFTALMOLOGIA TROPICAL SUL AMERICANA (Tropical Ophthalmology of South America). By Cesario de Andrade, formerly Professor of Ophthalmology in the School of Medicine of Bahia (Brazil). Stiff paper covers, illustrated. Rio de Janeiro, Rodrigues & Cia., 1940. Price not stated.

The tropical regions of the earth, with their enormous potentialities in agriculture and other forms of wealth, will gradually be conquered for civilized human habitation and enterprise. The most significant factor in such conquest will be an understanding of tropical diseases, their prophylaxis and treatment.

Cesario de Andrade, formerly Professor of Ophthalmology in the School of Medicine at Bahia, Brazil, is at present located in Rio de Janeiro. He is one of the seniors among Brazilian ophthalmologists, and has been selected to act as president of the examining board of ophthalmology which is now being established in his country.

The present work (in the Portuguese language) is an excellent survey of the field of tropical medicine, as it particularly affects the eye and its adnexa, and with special emphasis on those diseases which are common in Brazil and some other tropical and semitropical areas of South and Central America.

One is amazed at the extent to which the special diseases of the tropics are attributable to the activities of insects and other low forms of animal life. The scientific battle against these diseases demands knowledge of entomology, microbiology, parasitology, and mycology. The principal diseases dealt with in the present volume are the various forms of malaria, the dysenteries (amebic and bacterial), filariasis, ankylostomiasis, beri-beri, schistomycosis, leishmaniasis, foliaceous pemphigus, and American trypanosomiasis, as well as a host of other disorders whose very names are often unfamiliar to physicians in the United States.

The volume is divided into the following chapters: protozoöses, verminoses, bacterial diseases, mycoses, diseases produced by invisible viruses, diseases of uncertain etiology, ocular affections produced by the contact or sting of poisonous animals, and ocular affections produced by insects.

It is significant that the Spanish and Portuguese words for malaria carry the implication that this is a disease of swamps. Our own word means of course merely "bad air." It is interesting to reflect that the existence of malaria and other diseases of the warmer and moister climates probably had much to do with the institution of slavery. Before slavery was abolished in that region, the Portuguese possessions which are now Brazil are said to have imported from Africa the enormous number of 12,000,000 Negroes.

As bearing on the extent to which vascular spasm in malaria is attributable to quinine used in treatment, de Andrade cites a personal case in which binocular and generalized retinal vascular spasm lasted throughout the febrile seizure, although the patient had not previously received quinine.

Mention is made of the latest anopheles to be charged with the spread of malaria, namely, the A. gambiae, imported in fairly recent years from Africa. To exterminate this carrier from Brazil and surrounding areas the Rockefeller Foundation (International Health Board) has devoted the energy of 5,000 workers.

Trypanosomiasis is known in Brazil as Chagas's disease, in honor of the Brazilian pioneer in the investigation of this widespread European affliction. Intermediate hosts of this disease (which incidentally attacks the lids, conjunctiva, cornea, and ocular muscles) are a number of armadillos (forty percent of these animals being infected) and several domestic animals. One or two diseases mentioned by de Andrade seem hardly entitled to the limited designation of tropical but have a much wider distribution. Thus, for example, the spotted fever which has been called "typhus of São Paulo," or "typhus of Minas Gerais" (two southern states of Brazil) seems, according to recent investigation, to be identical with Rocky Mountain fever.

Special importance, in tropical and semitropical pathology, is attributed to poisoning produced by the venom of snakes, arthropods, and other animals.

De Andrade presents a formidable list of poisonous snakes whose abundance in the luxuriant vegetation of the jungle is responsible for a great number of casualties. The ocular complications include amblyopia or amaurosis, and muscle paralysis (especially ptosis). The great toxicity of the cobras is well known.

Brazil has a number of poisonous spiders. Other offenders are the scorpions and lizards. There are also in the tropics a great many bees and wasps.

"Oftalmologia tropical" is well written. The author frequently cites personal observations of the diseases under discussion. From the point of view of the scientific student the book has one serious defect. In each chapter there are numerous references to the work or writings of investigators and clinicians, but no attempt whatever has been made to furnish the reader with a bibliography of these references, or even to give in the text a broad indication as to where they are to be found.

W. H. Crisp.

EYE HAZARDS IN INDUSTRY, EXTENT, CAUSE, AND MEANS OF PREVENTION. By Louis Resnick. 321 pages, 33 illustrations, 15 tables and charts, bibliography, index. New York, published for the National Society for the Prevention of Blindness by the Columbia University Press, 1941. Price $3.50.

In 1917, the National Society for the Prevention of Blindness published the first handbook on industrial eye hazards. It was compiled by Gordon L. Berry. In 1924, Lewis H. Carris and Louis Resnick revised and enlarged the work and published it under the title, "Eye hazards in industrial occupations." The author of the present volume, a former director of industrial relations of the Society, has succeeded in bringing within the covers of a moderately sized and handy volume, a wealth of information and detail. It is well printed on good paper and adequately illustrated with interesting photographs and charts.

The volume is divided into two parts. The first deals with the problem, and covers by statistics and descriptive details the subjects of eye hazards, accidents, diseases, defective vision, and first aid in industries. The second part discusses the solution, and covers such subjects as mechanical guards; process revision, by which is meant the changing of mechanical design or the covering of parts in order to eliminate hazard; proper lighting, edu-

cation, and administrative supervision. Some of the most valuable information will be found in the appendices. For example appendix II outlines the industrial poisons that are hazardous to the eyes, and appendix III details the recommendations for minimum standards of illumination for industrial interiors.

The ophthalmologist will gather much interesting and important knowledge on subjects that are of significance to his clinical problems. The appearance of this book in these days of increasing production especially for defense and of growing awareness of the importance of industrial ophthalmology is timely. It is one of the most notable books in the ophthalmic field that has appeared this year.

Derrick Vail.

OBITUARIES

FRANCIS WAYLES SHINE
1874-1941

Dr. Francis Wayles Shine had a distinguished career in ophthalmology and practiced for 34 years before his death in September, 1941. He was born in Orlando, Florida, on June 25, 1874, the son of Captain Thomas J. Shine of the Confederate Army and of Virginia Eppes Shine, a great-granddaughter of Thomas Jefferson.

He attended Keswick Schools for Boys and Sewanee Military Academy and was graduated from the University of Virginia in 1898, with the degree of doctor of medicine.

In 1898-1900 he was clinical ophthalmic assistant in the New York Hospital's Westchester Division at White Plains, New York, then called Bloomingdale Hospital.

After practicing general medicine in Boston for three years, Dr. Shine studied ophthalmology in Prague and Vienna. Upon his return from Europe, in 1902, he entered the aural department of the New York Eye and Ear Infirmary, graduating in 1904. He received his diploma in

Francis Wayles Shine

ophthalmology in 1906, and began to practice ophthalmology and otolaryngology in New York City in 1907. He was an assistant ophthalmic surgeon to the New York Eye and Ear Infirmary in 1907, and an assistant aural surgeon in 1908. He became an attending ophthalmic surgeon at the hospital in 1917, and was appointed executive surgeon in 1929. In 1939, he was honored by being named a consulting ophthalmic surgeon at the Infirmary and a member of the board of directors.

He was appointed ophthalmologist to the New York Hospital in 1916, and served in this capacity until 1932, when he was made consulting ophthalmologist.

Dr. Shine also had a distinguished military career and served in France as a major with the American Expeditionary

Force in 1917. He went to France with the New York Hospital Unit and later served as ophthalmic consultant for the American Army in the Paris area.

He was a member of several societies, including the Section on Ophthalmology of the American Medical Association, American Academy of Ophthalmology and Otolaryngology, American Ophthalmological Society, New York Ophthalmological Society, and the New York Academy of Medicine. He was a member of the Metropolitan Club, Deepdale Golf Club, and the Racquet and Tennis Club. He was admitted to the American Ophthalmological Society in 1916. His excellent thesis was on "The Motais operation for ptosis." He was president of the New York Ophthalmological Society in 1917.

After having suffered from a serious heart ailment for more than a year, he retired from practice early in 1941, and left his home and office in New York to reside in Farmington, near Charlottesville, Virginia. He died on September 24, 1941, and was buried in the Jefferson family plot at Monticello, in the presence of his family and a large group of his devoted friends from New York and other cities.

He leaves a widow, the former Mrs. Edna Wood Bedell, and a sister, Mrs. Frank B. Stoneman of Miami, Florida.

Dr. Shine's modesty and his retiring nature endeared him to a host of loyal friends. Many of those closest to him never knew he was a direct descendant of Thomas Jefferson or learned of his distinguished service in France. He was also modest about his athletic ability, although he was an expert tennis player and had played quarterback on the 1893 football team of the University of Virginia. Only those actually associated with him in these sports ever knew of his athletic prowess.

Some idea of his eminence in ophthalmology may be gained from his positions of trust. At the time of his death he was consulting ophthalmic surgeon on the staffs of the New York Eye and Ear Infirmary, New York Hospital, and Doctors' Hospital, as well as director of the New York Eye and Ear Infirmary.

Because of his selflessness, his life of service to others, and his unfailing courtesy, he will be missed by his family and countless loving friends and devoted patients. Those who live a life of service and love humanity cannot escape reward, try as they will, and the honors bestowed on Dr. Shine prove that he was no exception to this rule.

Conrad Berens.

MELVILLE BLACK
1866-1941

Melville Black was born on March 15, 1866, at Washington in the southeastern part of Iowa. Early work in a drug store turned his attention toward the study of medicine, and he went to Bellevue Hospital Medical College in New York City, where he was graduated in 1889. Henry D. Noyes was professor of ophthalmology and otology at that time. It was his teaching that interested Dr. Black in special practice. After an internship in the Manhattan Eye and Ear Hospital, Dr. Black came to Denver in 1891 to engage in the practice of ophthalmology and otology. He was a member of the American Academy of Ophthalmology and Otolaryngology, and was one of the original members of the Colorado Ophthalmological Society, and of the American College of Surgeons. He was a member of the American Medical Association, and in 1908 was vice-president of its Section on Ophthalmology. He was active in the Colorado State Medical Society, and was chosen its president in 1922.

Having given much time to clinical work in the medical schools of Denver,

Dr. Black in 1933 became professor of ophthalmology in the School of Medicine of the University of Colorado. His most active interest was in ocular therapeutics. Without adding to the bulk of the literature of ophthalmology, he presented many cases to the local ophthalmological society, with intelligent discussion of their important features. His colleagues and students remember many evidences of his friendly interest and sound advice; he gave loyal support to the standards of medical ethics.

Edward Jackson.

CORRESPONDENCE

Higher criticism

To the Editor,
American Journal of Ophthalmology:

Who was it that inaugurated the now prevalent practice of using the term "intraocular tension" in stead of "intraocular pressure?" If he is not already dead, the matter of his death should be attended to. "Intraocular tensions" appear in each of your issues, and I observed that even a chairman's address to the Ophthalmic Section of the A.M.A. was liberally sprinkled with them. Moreover, even I who should have and did know better, once or twice followed this horrible precedent. Possibly this term has some meaning, but whatever this may be it certainly is not the meaning its users wish to imply. If the "intra" was dropped, the meaning would be somewhat definite, but would still refer to something that has never been directly measured. The expression "Tension = x mm. (Schiötz)" can be defended on the ground of brevity. I take it to mean the ocular tension produced by an intraocular pressure estimated to be x mm. of mercury by the amount of indentation of the cornea produced by the Schiötz tonometer. Incidentally, I may reiterate here that if "Souter" is substituted for "Schiötz," the estimate, when made by a practiced observer, is much more reliable.

(Signed) F. H. Verhoeff.

ERRATA

Due to delays in transit, author's proof of the article on "Cephalic tetanus following ocular injury" which appeared in the November issue, has just been received. The author's name was erroneously given as G. G. Jayme-Goyaz. It should be Dr. G. G. Jayme of Annapolis, Goyaz, Brazil.

In the News Items (under Personals) of the December issue, Dr. Everett L. Goar's name appeared as Gore.

ABSTRACT DEPARTMENT

EDITED BY DR. WILLIAM H. CRISP
ASSISTED BY DR. GEORGE A. FILMER

Abstracts are classified under the divisions listed below, which broadly correspond to those formerly used in the Ophthalmic Year Book. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

1. General methods of diagnosis
2. Therapeutics and operations
3. Physiologic optics, refraction, and color vision
4. Ocular movements
5. Conjunctiva
6. Cornea and sclera
7. Uveal tract, sympathetic disease, and aqueous humor
8. Glaucoma and ocular tension
9. Crystalline lens
10. Retina and vitreous
11. Optic nerve and toxic amblyopias
12. Visual tracts and centers
13. Eyeball and orbit
14. Eyelids and lacrimal apparatus
15. Tumors
16. Injuries
17. Systemic diseases and parasites
18. Hygiene, sociology, education, and history
19. Anatomy, embryology, and comparative ophthalmology

10

RETINA AND VITREOUS

Graham, R. W. **Ophthalmoscopically visible retinal lesions in chronic glomerulonephritis.** Arch. of Ophth., 1941, v. 26, Sept., pp. 435-465.

The occurrence and type of retinal lesions were studied in 56 cases in which necropsy revealed definite evidence of chronic glomerulonephritis. The most characteristic retinal picture was an acute angiospastic type of retinitis without evidence of chronic sclerosis of the retinal arterioles. It occurred in 55 percent of the 56 cases studied and in 67 percent of the 46 cases in which retinitis of any type was present. In cases in which renal arteriolosclerosis was present, the blood pressure was definitely higher, and remained so for a longer time, and the palpable peripheral sclerosis was of higher grade than in the uncomplicated cases. A similar change in the arterioles was observed in other organs in cases in which marked renal arteriolosclerosis was present. In the group of cases studied, 10 had normal fundi, 7 had retinitis of anemia, and 39 had acute angiospastic retinitis, both with and without chronic sclerosis of the retinal arterioles. Illustrative cases and a summary of the findings in each group are reported. As a result of this study the author concludes that when nephritis is complicated by a marked degree of sclerosis of the renal arterioles, a demonstrable degree of chronic sclerosis will be present in the retinal arterioles, in addition to retinitis. The onset of the acute angiospastic type of retinitis without chronic sclerosis of the retinal arterioles is an extremely grave prognostic sign, since the mean subsequent duration of life of these patients will be only four months. The blood-pressure readings of patients with retinitis will generally be higher at or near the time of the onset of the retinitis than those of glomerulonephritic patients in whom retinitis does not develop. In cases of chronic glomerulonephritis with retinitis, hy-

pertension and arteriolar constriction or spasm seem to be the most potent factors in the production of retinal lesions and these will vary considerably depending on the phase of the disease at the time the ophthalmoscopic examination is made. The retinitis may develop a considerable time before death of the patient, and may persist throughout the course of the disease or may regress or disappear; or it may appear only in the terminal stage. In some cases no retinal abnormalities will be apparent at the time of death, either because the retinitis previously present has cleared up or because retinitis has never occurred.

J. Hewitt Judd.

Gralnick, Alexander. **The retina and intraocular tension during prolonged insulin coma.** Amer. Jour. Ophth., 1941, v. 24, Oct., pp. 1174-1185.

Keith, N. M., Rucker, C. W., and Parkhill, E. M. **Recession of retinal papilledema during terminal stage of malignant hypertension.** Arch. of Ophth., 1941, v. 26, Aug., pp. 240-246.

The disappearance of a previously measurable papilledema and the recession of the retinal hemorrhages and exudates of a retinitis associated with malignant hypertension in a man of 38 years were noted during the progressive terminal course, 19 days before death. Pathologic examination of the eye revealed retinitis of the hypertensive type and sclerosis of the choroidal arteries, but absence of papilledema. The subsidence of the neuroretinal edema, usually associated with temporary remission of the diffuse disease, occurred when the patient was almost moribund, and when the diffuse vascular process was definitely progressive elsewhere as evidenced by increasing dysfunction of the brain, heart, and kidneys. While there is no simple explanation for the recession, it is possible that some compensating mechanism or mechanisms develop at this particular time in the peripheral vascular blood supply to the retina. An unequal histopathologic involvement of the retinal arterioles suggests that there may have been a sufficient number of normal arterioles present in the retina to give a blood supply adequate for reabsorption of the papilledema. (Photomicrographs.) J. Hewitt Judd.

Lagrange, Henri. **Primary retinal infiltration of pale, pulverulent, stellate, and purpuric character and accompanying nephritis is a pathognomic sign of azotemic anemia.** Brit. Jour. Ophth., 1941, v. 25, Sept., pp. 443-450.

The author notes a close relationship between azotemia and the anemia accompanying nephritis. Findings of retinal infiltration may indicate the malignant nature of these forms of anemia before the clinical and hematologic signs are fully evident. (Table, references.) D. F. Harbridge.

Lee, R. H. **The ocular fundus in diabetes mellitus.** Arch. of Ophth., 1941, v. 26, Aug., pp. 181-202.

The author reviews the literature and presents his findings in a study of one hundred cases observed in the metabolic department of the Philadelphia General Hospital. The statistics were assembled in five tables, according to age groups. There were no changes in the fundus of the first group of patients (below the age of 40 years). In the second age group (40 to 49 years) every patient with marked retinal disturbance had, in addition to different degrees of sclerosis, some abnormality of blood pressure, and in every case

except two the electrocardiogram showed myocardial degeneration. In patients of the third group (50 to 59 years) it was rare not to find retinal lesions of diabetes, and in the majority of these the electrocardiogram revealed pathologic change. Among the fourth group (60 to 69 years) electrocardiograms revealed pathologic changes of the heart and vascular system in almost every case. However, the cases were evenly divided as to the presence or absence of retinal changes. Sclerosis and hypertension were evident in every case. The findings in the fifth group (70 to 77 years) corresponded closely to those in the fourth. In 69 percent of the cases there were definitely no changes in the fundus. Metabolic disturbance alone did not seem responsible for the retinal changes. In the majority of the cases of diabetic retinitis, arteriosclerosis, hypertension, and nephritis, or some of these factors, were present, frequently complicated by myocardial degeneration.

J. Hewitt Judd.

Loewenstein, A., and Steel, J. **Special case of melanosis fundi: bilateral congenital group pigmentation of the central area.** Brit. Jour. Ophth., 1941, v. 25, Sept., pp. 417-423.

Observations of an exceptional case are presented, a typical case being first outlined for contrast. The authors' case showed a large central group of pigment splotches, the two eyes being symmetrical, and some of the splotches containing grayish-white "corpuscles," possibly cystic. D. F. Harbridge.

McKee, S. H. **Examination of the fundus in 2,360 diabetics.** Canadian Med. Assoc. Jour., 1941, v. 45, Aug., pp. 127-129. (See Amer. Jour. Ophth., 1941, v. 24, Sept., p. 1100.)

MacRae, Alex. **Two cases of familial macular degeneration.** Trans. Ophth. Soc. United Kingdom, 1940. v. 60, p. 239.

Pigmentary changes at the macula occurred in two sisters, neither of whom had shown signs of defective vision before the age of 10 years. The gradual deterioration of vision, the absence of night blindness or loss of peripheral field, and the retention of mental alertness seem to place these cases in the group of familial macular degeneration without cerebral involvement. Beulah Cushman.

Mandelbaum, Joseph. **Dark adaptation.** Arch. of Ophth., 1941, v. 26, Aug., pp. 203-239.

The measurement of light thresholds for different retinal areas permits, for the first time, a really quantitative method of retinal-sensitivity topography. In cases in which a relative defect is indicated by quantitative perimetry, the exact extent of loss of retinal sensitivity may be measured most simply by threshold determinations. The author discusses the physiologic requirements for proper dark-adaptation measurements. These include control of brightness, of duration of exposure, of retinal fixation, and of size and color of test area. The achromatic threshold, as measured with violet light, shows a direct dependence on the size of the pupil; the chromatic threshold, as measured with red light, falls a little short of the direct proportionality curve. Correction curves for pupil size are presented. Various objections to the photochemical theory of dark adaptation are discussed. The demonstration of complete independence of the two eyes in regard to adaptation and the failure of various neurotropic drugs to affect signifi-

cantly the course of dark adaptation support the photochemical theory of vision. Determinations of dark adaptation in 110 normal persons, corrected for a 2-mm. pupil, show a range in rod thresholds from 3.5 to 4.5 log micromicrolamberts; the cone thresholds range from 6.0 to 6.8 micromicrolamberts. Normal retinal-sensitivity contours both for cones and for rods are presented. Rod sensitivity apparently depends on the rod population. The cone-threshold level is the same from the fovea to 20 degrees peripherally, despite large changes in the cone population. In vitamin-A deficiency the most striking change in dark adaptation is the rise of the rod and cone thresholds. Retinal-sensitivity contours remain normal in shape. In no pathologic condition of the eye has there been observed a specific retardation in the speed of the dark-adaptation curve. In retinitis pigmentosa the rod function is diminished to a much greater extent than the cone function. The depression or peripheral retinal sensitivity is characteristically symmetric around the fovea. In glaucoma and atrophy of the optic nerve, cone and rod function are depressed about equally. Elevated cone and rod thresholds indicate diminished retinal sensitivity but the dynamics of dark adaptation do not appear to be altered.

J. Hewitt Judd.

Milch, E. C. **Changes in retinal arteries before convulsions induced by electric shock.** Arch. Neurol., and Psychiatry, 1941, v. 45, May, p. 848.

The author finds that there is no prolonged effect on the artery, and any immediate effect is of dilatation. In all cases in which a sufficiently prolonged period of unconsciousness preceded the active convulsive state, the retinal arteries constricted prior to the onset of the convulsion. In a majority of the cases in which during the period of "absence" no retinal constriction occurred, there was also no convulsion.

Theodore M. Shapira.

O'Brien, C. S., and Allen, J. H. **Unusual changes in the retinal veins in diabetes.** Sec. on Ophth., Amer. Med. Assoc., 1940, 91st mtg., pp. 148-164. (See Amer. Jour. Ophth., 1941, v. 24, p. 244.)

Serr, H. **A comparative study of the localization of retinal tears by Gonin's method and by Weve's method.** Graefe's Arch., 1940, v. 141, pt. 6, pp. 655-661.

A comparison of the Gonin and Weve methods of localizing retinal holes was made in 17 cases of retinal separation. The hole was localized before operation by Gonin's method. (The distance behind the ora serrata is determined ophthalmoscopically and the meridian is marked at the limbus.) At operation after the sclera had been freed the hole was localized by Weve's method. (With a strong light and indirect ophthalmoscopy the hole is visualized. The light focused on the hole shines through the sclera and the point is marked by an assistant.) A single diathermy puncture was made at the marked point and examined ophthalmoscopically to determine how accurately localization had been accomplished.

By Gonin's method the hole was localized within 1.5 mm. with the exception of three cases in which there was a marked ballooning separation. By Weve's method the hole was localized exactly in all but six cases. Three of these were within 1.5 mm. of the hole and the other three, which showed greater errors, were the above-men-

tioned cases of ballooning separation.

Weve's method has the advantages that the hole is localized in one procedure and that holes in the far periphery can be better visualized. But it requires an assistant and the media must be clear during the entire operation. To maintain optimum clarity of the cornea the author uses only a subconjunctival injection of novocaine.

Frances C. Cogan.

Van Manen, J. G. **A congenital anomaly of the fundus oculi.** Arch. of Ophth., 1941, v. 26, July, pp. 1-5.

In one eye of a man aged 19 years was found a cudgel-like mass lying with its central end in front of the temporal edge of the disc, and extending temporally to end in a knob-like formation just past the fovea centralis. A groove in the central swelling of the cudgel-like mass became deeper as it passed toward the center. It penetrated in a slanting direction until it became tube-like and appeared to end at the point where the retinal vessels emerged from the disc. The posterior side of the mass was adherent to the retina along its whole length and caused the latter to be lifted up from its pigment layer like a tent. This partial congenital falciform detachment differs from the typical type in that the retinal fold is not continued to the periphery. The author considers the cause of the anomaly to be a fetal adhesion between the walls of the peripheral hyaloid artery (one of the vasa hyaloidea propria) and the inner layers of the retina. As the eye developed and the primary vitreous was pushed to the center, this abnormally persisting tissue was tightened and ran like a cord through the eyeball. The nerve layer of the optic cup was prevented by this adhesion from following the pigment layer along the inner side of the eyeball, and so a tent-like retinal detachment was formed. The groove in the central swelling of the cudgel-like mass was the entrance to the tunnel through which the main branch of the hyaloid artery had run. Examination of the father's eye showed congenital lens opacities which were considered to be the result of a fetal disturbance in the nutrition of the lens through the hyaloid vessel system. Hence it might be concluded that the same disturbance in the germ of the father and of the son gave rise to two different congenital abnormalities of the eye.

J. Hewitt Judd.

Walker, G. L., and Leinfelder, P. J. **Retinal hemorrhage following transfusion.** Arch. of Ophth., 1941, v. 26, Sept., pp. 489-493.

Fresh retinal hemorrhages after transfusion were observed in three cases here reported. In these the clinical diagnoses were appendical abscess, diabetes mellitus, and myelogenous leukemia. In each case only a single small flame-shaped or punctate hemorrhage was found in one or both eyes. Although retinal hemorrhage after transfusion is not common, the frequency is much greater among patients in whom a tendency to spontaneous retinal bleeding exists, but in such cases fresh hemorrhage after transfusion is perhaps coincidental. No relation exists between retinal hemorrhage after transfusion and minor reactions or between retinal hemorrhage after transfusion and the degree of anemia.

J. Hewitt Judd.

Weve, H. J. M. and Fischer, F. P. **On the origin and composition of the subretinal fluid in retinal detachment with rupture.** Ophthalmologica, 1941, v. 102, July, p. 13.

In an earlier article (Amer. Jour. Ophth., 1940, v. 23, p. 1427) the authors reported the results of their investigations of the origin and composition of the subretinal fluid in retinal detachment. In this article the micromethods used in the investigation are described in detail. The authors find that the fluid includes a small proportion of heavy water whose origin is in the pigment epithelium. The original fluid has the same composition as and is similar to vitreous, but it soon becomes modified by the characteristics of the tissues with which it comes in contact.

F. Herbert Haessler.

11

OPTIC NERVE AND TOXIC AMBLYOPIAS

Athens, A. G. **Glaucoma associated with hyaline bodies (drusen) of the optic disc.** Amer. Jour. Ophth., 1941, v. 24, Oct., pp. 1138-1143.

Eggert, Wolfgang. **Etiologic viewpoints in several obscure cases of optic neuritis.** Klin. M. f. Augenh., 1941, v. 106, March, pp. 320-332.

Eight cases are reported in which it was difficult to detect the causative agent. Multiple sclerosis was assumed to be the cause in the majority although it could not be diagnosed with certainty. Infection of the teeth and sinuses were considered possible but not likely. One of the reported cases was of sympathetic iridocyclitis, with neuritis occurring 18 days after enucleation of an eye following a perforating injury. In this, as in all the other cases, the vision was restored to normal within a short period.

Gertrude S. Hausmann.

Friedman, Benjamin. **Deep cupping of nerve head in atrophy of optic nerve due to methyl alcohol: complicated by amblyopia due to tobacco and ethyl alcohol.** Arch. of Ophth., 1941, v. 26, July, pp. 6-11.

A man, aged 46 years, had 22 years before suffered from wood-alcohol poisoning with resulting defective vision in one eye, due to atrophy of the optic nerve accompanied by deep cupping of the disc. The fundus picture was so similar to that associated with glaucoma that the diagnosis was difficult. There was a history of excessive use of tobacco and ethyl alcohol. This, with the possible presence of avitaminosis and the exclusion of other probable causes, and also the prompt and spectacular recovery following the use of vasodilators and vitamin-B complex, are adequate reasons for the diagnosis of toxic amblyopia due to ethyl alcohol and tobacco superimposed on an old atrophy of the optic nerve due to methyl alcohol. Whether the atrophic nerve is more susceptible than the normal nerve to toxic influences is an interesting question. J. Hewitt Judd.

Friesner, Isidore. **An analysis of the ocular fundus changes in otitic sinus thrombosis.** Annals Otol., Rhin., and Laryng., 1941, v. 50, March, p. 32.

The author finds that no firm basis as to cause or papilledema in sinus thrombosis is established. One factor which must be very strongly considered is inflammation and edema of the dura. Theodore M. Shapira.

Keschner, M., and Rosen, V. H. **Optic neuritis caused by a coal-tar hair dye.** Arch. of Ophth., 1941, v. 25, June, pp. 1020-1024. (See Section 16, Injuries.)

Pŏstić, Svetozar. **Gumma of the orbit with papilledema.** Graefe's Arch., 1940,

v. 141, pts. 4 and 5, pp. 561-563. (See Section 13, Eyeball and orbit.)

Pŏstić, Svetozar. **Paget's osteitis deformans with unilateral atrophy of the optic nerve.** Graefe's Arch., 1940, v. 141, pts. 4 and 5, pp. 564-566.

The case of a 61-year-old man with Paget's disease and unilateral optic atrophy is reported. The pupillary reaction was normal. The visual field showed concentric narrowing in the periphery with an enlarged blind spot. The other eye was normal. The Wassermann reaction was negative. X ray revealed the typical bony changes of Paget's disease in the skull and vertebrae. The optic canal on the affected side appeared to be narrow. The author concludes that the optic atrophy occurred as a result of the narrowing of the optic canal and cites a similar case reported by Hansen as confirmatory evidence. Frances C. Cogan.

Scheie, H. G., and Adler, F. H. **Aplasia of the optic nerve.** Arch. of Ophth., 1941, v. 26, July, pp. 61-70.

The nature of the embryologic disturbance of partial or complete aplasia of the optic nerve is discussed. Reports of five cases of partial aplasia, or hypoplasia, of the optic nerve in otherwise normal eyes were collected from the literature. In the authors' case, a three-year-old boy in whom bilateral aplasia was present, the eyes had developed normally except for failure of development of the ganglion-cell layer of the retina. The optic-nerve head, though small because of absence of nerve fibers, was present, as evidenced by the central vessels. The macula was granular in appearance, with the foveas unusually dark. No lesions of the fundus were seen in either eye. The history of normal development and the absence of systemic and neurologic disease were helpful in differentiating this condition from atrophy of the optic nerve.

J. Hewitt Judd.

Werner, Konrad. **The origin of optic neuritis during the lactation period.** Klin. M. f. Augenh., 1941, v. 106, March, pp. 314-320.

Two cases of optic neuritis during lactation are only indirectly attributed to lactation. The general weakness and loss of blood during confinement cause a weakening of the organism that increases its susceptibility to infectious agents. Gertrude S. Hausmann.

12

VISUAL TRACTS AND CENTERS

Adrogué, Esteban. **A case of bitemporal hemianopsia due to pressure of the anterior cerebral artery.** Arch. de Oft. de Buenos Aires, 1939, v. 14, Dec., p. 999.

A 27-year-old man had complained of difficulty in reading for several months. The visual fields showed an absolute bitemporal paramacular hemianopsia more marked in the left eye. Central vision was normal. General physical and neurologic examinations were negative. X ray of the skull showed a definite enlargement of the sella turcica with some displacement of the clinoid processes. An exploratory craniotomy revealed a pituitary adenoma upon which the left and anterior cerebral artery had pressed a groove. Twenty days after the removal of the adenoma the visual fields were found to be entirely normal. There is a brief review of the literature. (Visual field charts, X rays.) Plinio Montalván.

Akelaitis, A. J. **Studies on the corpus callosum: 2. The higher visual functions in each homonymous field follow-**

ing complete section of the callosum. Arch. of Neurol. and Psychiatry, 1941, v. 45, May, p. 788.

On the basis of his study of six epileptic patients in whom the corpus callosum was completely sectioned, the author cannot lend support to the theory that a unilateral cerebral dominance exists in the elaboration of visual perception. Theodore M. Shapira.

Fridenberg, Percy. **The "Foster Kennedy" syndrome.** Arch. of Ophth., 1941, v. 26, Aug., pp. 288-290.

The author points out that Leslie Paton was first to describe, analyze, and explain what is now referred to as the "Foster Kennedy" syndrome. Paton's article (Brain, 1909, v. 32, p. 68) appeared two years prior to Kennedy's article. J. Hewitt Judd.

Maclay, W. S., and Guttman, E. **Mescaline hallucinations in artists.** Arch. Neurol. and Psychiatry, 1941, v. 45, Jan., p. 130.

The various theories as to the cause of hallucinations have been largely influenced by the material which the writers studied. They refer to a previous paper in which drawings by the patient were used to study schizophrenic symptoms of the visual type, but the scope of the experiment was limited because of the inability of the patients to draw well. The authors, therefore, conceived the idea of administering an appropriate amount of mescaline to artists who could more accurately record their hallucinations. Nine figures are given showing the patterns that were predominant. The observations provide material for discussion of the two opposing views concerning the origin of hallucinations: the physiologic theory, by which they are regarded as the result of irritation of sensory centers or pathways, and the psychologic, by which they are regarded as projected mental images assuming an external sensory appearance when presented to consciousness. In this experiment hallucinations during mescaline intoxication could be explained on neither physiologic nor psychologic terms alone. The authors stress the observation that the results of mescaline intoxication here observed cannot be applied to other types of hallucinations without additional study. (9 figures, references.)

Ralph W. Danielson.

Talbot, S. A., and Marshall, W. H. **Physiological studies on neural mechanisms of visual localization and discrimination.** Amer. Jour. Ophth., 1941, v. 24, Nov., pp. 1255-1263.

13

EYEBALL AND ORBIT

Pŏstić, Svetozar. **Gumma of the orbit with papilledema.** Graefe's Arch., 1940, v. 141, pts. 4 and 5, pp. 561-563.

A 13-year-old girl with a doubtfully positive Wassermann developed a unilateral papilledema of 3 to 4 diopters. The conjunctiva was markedly injected and there was a luetic iritis. Visual acuity was practically normal and the visual fields showed merely enlargement of the blind spot. No mention was made of exophthalmos. Under antiluetic treatment the iritis and the conjunctival injection disappeared but the papilledema persisted for two years. X ray suggested tumor in the orbit and a clinical diagnosis of gumma near the superior orbital fissure was made. The author concludes that pressure on the orbital veins produced the venous stasis and the papilledema.

Frances C. Cogan.

Somerville-Large. **A case of congenital anophthalmia.** Trans. Ophth. Soc. United Kingdom, 1940. v. 60, p. 243.

Somerville-Large reports a case of congenital anophthalmia in a girl, eight months of age, who had been under his care from the second day of life. Definite bodies could be palpated in the apex of the orbit but no movement could be detected. The orbits were of good size and the lids normal and non-adherent. An angioma on the left lower lid disappeared after use of radium. No other abnormalities were present. A prothesis had been fitted to each socket at the age of seven months. There was no history of ocular trouble in the family. Beulah Cushman.

Wilson, R. P. **Microphthalmia with cyst.** Giza Mem. Ophth. Lab., 1938, 13th rept., p. 70.

Microscopic sections showed a cyst lined with neuro-epithelium and surrounded by an incomplete fibrous capsule representing the sclera. Three types of tissue could be recognized in the specimen: (1) folds of malformed retinal tissue with rosettes, (2) vascular pigmented tissue, representing the choroid, and (3) folded hyaline membrane lined by cubical cells, representing the capsule of the lens. In the fibrous capsule (sclera) there were some nerve fibers, and a thickened bundle of nerve fibers probably was a rudimentary optic nerve.

Edna M. Reynolds.

14

EYELIDS AND LACRIMAL APPARATUS

Fazakas, Alexander. **Impediments in the patency of the tear ducts.** Klin. M. f. Augenh., 1941, v. 106, March, pp. 283-291.

The different forms of congenital malformation of the tear points and canaliculi are discussed. Occlusion of the tear ducts by tumor or fungi is mentioned. Strictures caused by scarring respond favorably to dilating.

Gertrude S. Hausmann.

Hughes, W. L., Guy, L. P., and Bogart, D. W. **Dacryocystorhinostomy.** Surg., Gynec., and Obstet., 1941, v. 73, Sept., pp. 375-380.

The authors discuss the subject in detail, including the indications, contraindications, advantages, operative technique, complications, and final results. They describe the technique as used at the New York Eye and Ear Infirmary, in which the opening is made into the nose with a chisel or hand trephine after the sac is exposed. An H-shaped incision is then made in both the sac and nasal mucosa, with the flaps outlined so that the upper and lower halves of each will correspond. Anterior and posterior sutures are then placed uniting the sac and nasal mucosa. The sutures materially increased the percentage of successes, which in the total series of 93 cases was 53. 7.

T. E. Sanders.

Kravitz, Daniel. **Boeck's sarcoid.** Arch. of Ophth., 1941, v. 26, July, pp. 102-107.

A woman aged 49 years presented a small cyst high on the left upper lid. It was fairly firm and freely movable except at its nasal end. A somewhat flat tumor which passed back into the orbit was found and excised. This case is unusual in that there was no cutaneous involvement and no tendency toward spreading of the lesion to other parts of the body, thus indicating that sarcoid may vary from a widespread disease with a fatal termination to a disease so benign that its only mani-

festation is an isolated small tumor. Though it is still in dispute whether Boeck's sarcoid is a form of tuberculosis, it is difficult to link the two since, pathologically, caseation is never present in sarcoid, the giant cells are different from those associated with tuberculosis, no evidence of tuberculosis is found elsewhere in the body, and negative results of animal-inoculation tests and absence of tubercle bacilli are almost constant observations.

J. Hewitt Judd.

Leopoldsberger, W. **Contributions to the etiology of premature depigmentation of lashes and eyebrows.** Klin. M. f. Augenh., 1941, v. 106, March, pp. 343-347.

The author reports an isolated depigmentation of one eyebrow and the lashes of the corresponding upper lid in a case of localized scleroderma. The pathology of the skin was of such minor degree that it was overlooked at first. Chronic iridocyclitis is mentioned as another cause of depigmentation of lashes.

Gertrude S. Hausmann.

Lukić, Djordje. **Dacryocystorhinostomy in chronic purulent dacryocystitis with positive bacteriologic findings.** Klin. M. f. Augenh., 1941, v. 106, March, pp. 291-295.

In a series of seven cases with chronic purulent dacryocystitis an operation after Ohm-Dupuy-Dutemps or Toti was performed. In spite of the fact that pus was present and during the operation sometimes emptied from the sack into the wound, all cases healed without complication. The reason why no infection took place may have been due to a local immunity following the long inflammation, or to the fact that the wide opening into the nose allowed an easy draining of the pus. (One table). Gertrude S. Hausmann.

Mueller, P. **Removal of cicatricial ectropion by free transplantation.** Schweiz. med. Woch., 1941, v. 71, Jan. 4, p. 5.

The author reports two cases in which Thiersch grafts were used with excellent results. (6 photographs.)

Theodore M. Shapira.

Traquair, H. M. **Chronic dacryocystitis, its causation and treatment.** Arch. of Ophth., 1941, v. 26, Aug., pp. 165-180.

The study of 1,073 patients who complained of tearing in one or both eyes revealed 548 adults with primary or secondary dacryocystitis. The primary form is common and is characterized by a pronounced sex predilection, occurring in women to the extent of eighty percent or more. Heredity appears to be the most important factor in its causation. The secondary form, which is due to injury or disease of the neighboring parts, is rare and occurs about equally in the two sexes. Except in the congenital form, in which expression of the sac and probing will usually effect a cure, the best treatment is a drainage operation. A modification of Toti's external dacryocystorhinostomy is advocated. In the author's series, 335 external dacryocystorhinostomies were done, and the sac was excised 74 times. In eighty percent of the dacryocystorhinostomized eyes, the tearing was said to have ceased. Only 35 percent of the excision operations produced satisfactory results. In cases in which excision was done on one side and dacryocystorhinostomy on the other, the difference between the two eyes was striking. The author outlines

the technique of his operation and considers the contraindications.

J. Hewitt Judd.

Yanes, T. R. **Dacryocystorhinostomy.** Arch. of Ophth., 1941, v. 26, July, pp. 12-19.

The author traces the development of the operation of dacryocystorhinostomy and explains why the method in which the mucous membrane of the lacrimal sac is sutured to the nasal mucosa is considered superior. The plastic operation is indicated in all cases of chronic dacryocystitis in which conservative methods produce no improvement and in which the lacrimal canaliculi and points are patent. It is the only advisable operation for the surgical treatment of lacrimation due to traumatic or nontraumatic obstruction of the lower lacrimal ducts. The technique of the author's operation, which is a modification of the Dupuy-Dutemps operation, is described. (Discussion.) J. Hewitt Judd.

15

TUMORS

Atallah. **Adenocarcinoma of lacrimal gland.** Giza Mem. Ophth. Lab., 1938, 13th rept., p. 60.

Neither the lid nor the conjunctiva of the fornix was affected by the tumor mass, which was large enough to push the eye downward and inward. There was also no involvement of the roof of the orbit. Edna M. Reynolds.

Bassili, Toma. **Capillary hemangioma of caruncle.** Giza Mem. Ophth. Lab., 1938, 13th rept., p. 49.

A case report.

Cullom, M. M., and Goodpasture, E. W. **Boeck's sarcoid.** Arch. of Ophth., 1941, v. 26, July, pp. 57-60.

The case reported is apparently the second one of bilateral sarcoid of the lacrimal gland in which the patient underwent operative removal of the tumor. A negress aged 24 years presented a large swelling of each upper lid of four months duration which gradually increased in size during that time. She could see only by tilting her head backward at an awkward angle, as the openings between the lids were narrow slits. The tumor was removed from each orbit, and histologic examination identified it as Boeck's sarcoid. There was a striking improvement in the general physical condition following the operation. J. Hewitt Judd.

Dewairy. **Multiple dermoids of conjunctiva.** Giza Mem. Ophth. Lab., 1938, 13th rept., p. 52.

A case report.

Fadl, Abul. **Adenoid epithelioma of eyelid.** Giza Mem. Ophth. Lab., 1938, 13th rept., p. 38.

A case report.

Goldman, H. and Grünthal, E. **A tumor of the optic nerve and its leptomeninges in Recklinghausen's disease.** Ophthalmologica, 1941, v. 102, Aug., p. 79.

The authors describe a tumor found in the optic nerve and its meninges in a child of five years. The patient had typical café-au-lait spots in the skin, such as are typically found in Recklinghausen's disease. The father and one brother had similar skin lesions, but no member of the family had peripheral neurofibroma.

Histologic study revealed a mass which was essentially a fibromatous proliferation of the leptomeningeal covering of the optic nerve, and whose cellular structure was meningiomatous.

There was glial proliferation in the atrophic optic nerve and into the tumor. It corresponded to Davis's third stage of tumor development in Recklinghausen's disease. A striking characteristic was proliferation of medullated nerve fibers and neurofibrils into the perineural tissue. These fibers were embedded in the collagenous connective tissues. They had bulbous ends, described by Verhoeff as "cytoid bodies."

The tumor is doubtlessly a partial manifestation of a central neurofibromatosis. Since the light brown spots in the skin are frequently the only manifestation of a generalized neurofibromatosis, these insignificant lesions must be sought for in a patient with optic-nerve tumor, and also in his relatives, to help establish a correct diagnosis. F. Herbert Haessler.

Gomes, J. P. **Tumors of the optic nerve.** Amer. Jour. Ophth., 1941, v. 24, Oct., pp. 1144-1167. (28 illustrations.)

Klien, B. A. **Detachment of the pars ciliaris retinae.** Arch. of Ophth., 1941, v. 26, Sept., pp. 347-357.

Two cases are reported in which detachment of the pars ciliaris retinae was observed in the first stage of malignant melanoma of the choroid. The affected eye was enucleated in each case, and histologic findings are reported and illustrated with photomicrographs. Differential diagnosis between detached retina and extensively detached ciliary epithelium is presented. Several groups of eyes were studied histologically in search of the combination of detachment of the pars ciliaris and of the pars optica retinae. In injured eyes and in those with perforated corneal ulcers, when detachments can be seen, their relation to the perforating scars and other conditions is usually sufficient to exclude the question of tumor. In the remaining groups of eyes with retinal detachment, whether idiopathic or due to Coats's disease or intraocular tumors, it is significant that the combination of detachment of the pars optica and of the pars ciliaris retinae has been found only in those with tumors. It would seem that the clinical finding of a detached unpigmented ciliary epithelium points almost certainly to a condition producing an increased subretinal pressure, and suspicion of a tumor in such an eye should be entertained. Even a small tumor may cause an extensive retinal detachment and thus, by its small size or posterior location, may make the results of transillumination doubtful. The additional finding of a detached pars ciliaris retinae in such eyes should add more certainty to the clinical diagnosis of tumor. Its special value in cases of tumor located too far back to permit of decisive observation on transillumination is shown by the fact that its occurrence with tumors has been limited, with two exceptions, to tumors which were located posterior to the equator. Hence systematic ophthalmoscopic examination should include careful study of the peripheral portions of the detached retina (if possible with the aid of a contact lens) for detachment of the unpigmented ciliary epithelium. J. Hewitt Judd.

Mahfouz. **Fibrosarcoma of eyelid.** Giza Mem. Ophth. Lab., 1938, 13th rept., p. 43.

A case report.

Moffatt, P. McG. **An orbital dermoid (lined by skin and modified conjunctiva).** Brit. Jour. Ophth., 1941, v. 25, Sept., pp. 428-430.

In a youth aged 19 years, a swelling

had been present at the upper and outer edge of the left orbit as long as the patient could remember. Increasing in size and becoming painful the swelling was removed. Pathologic findings of the excised cyst are described in full. (Figures.) D. F. Harbridge.

Robson, S., Blackwood, W., and Cookson, H. A. **A case of Recklinghausen's disease with diffuse neurofibromatosis of the choroid.** Brit. Jour. Ophth., 1941, v. 25, Sept., pp. 431-442.

This case is that of a boy, aged 18 years, with a four-year history of a thickened and enlarged upper right lid, movement being completely restricted. The right eye was later enucleated, there being a detached retina, and an eccentric, pear-shaped pupil, larger than the left, and reacting sluggishly to light. No tumor was found in the orbit following enucleation. When the patient was first seen there were movable swellings on the right side of the neck and under the skin, with brownish patches on other parts of the body. Reports on biopsies taken previous to enucleation are given, as are comments and discussions on the characteristics and classification of such pigmentation and ovoid bodies. (Photomicrographs, references.) D. F. Harbridge.

Rottino, Antonio, and Kelly, A. S. **Specific nerve-sheath tumor of orbit (neurilemmoma, neurinoma).** Arch. of Ophth., 1941, v. 26, Sept., pp. 478-488.

A case of a neurilemmoma occurring in the orbit of a woman of 59 years is reported, together with a review of 11 cases from the literature. This tumor, which is solitary and benign, originates in a nerve sheath and may appear in either the central or the peripheral nervous system. It usually grows at a slow rate, progressively, or intermittently with varying static intervals. The tumor is essentially solid and gray and has a specific histologic appearance. Portions of the tumor here reported were composed of Antoni type-A tissue, while other areas exhibited the marked regressive changes so characteristic of this tumor, namely type-B tissue infiltration with lipoid-ingesting macrophages, cysts, and thick-walled blood vessels. This tumor is to be differentiated from solitary neurofibroma and plexiform neurofibroma of the orbit. The pathologic findings are illustrated with photomicrographs.
J. Hewitt Judd.

Sadik, T. **Glioma of retina in congenitally malformed eye.** Giza Mem. Ophth. Lab., 1938, 13th rept., p. 65.

Microscopically, the eye showed a glioma of the optic nerve in addition to a persistent hyaloid membrane and a persistent tunica vasculosa lentis. In the retina, which was detached by the tumor growth, the layers of ganglion cells and of rods and cones were absent. The optic nerve showed no nerve fibers but only tumor-tissue infiltration. Edna M. Reynolds.

Wilson, R. P. **Adenoma of meibomian gland.** Giza Mem. Ophth. Lab., 1938, 13th rept., p. 46.

A case report.

Wilson, R. P. **Cavernous hemangioma of orbit.** Giza Mem. Ophth. Lab., 1938, 13th rept., p. 64.

There was a history of proptosis of the left eye of 14 years' duration with rapid increase during the last two years. An encapsulated tumor was removed by Krönlein operation, and the eye which had previously been almost outside the orbit retained 3/60 vision.
Edna M. Reynolds.

Wilson, R. P. **Dermolipoma of conjunctiva containing cartilage.** Giza Mem. Ophth. Lab., 1938, 13th rept., p. 54.

A case report.

Wilson, R. P. **Mixed tumor of serous glands of eyelid.** Giza Mem. Ophth. Lab., 1938, 13th rept., p. 41.

A case report.

Wilson, R. P. **Reticulum-cell sarcoma of orbit.** Giza Mem. Ophth. Lab., 1938, 13th rept., p. 62.

A biopsy report. Complete removal of the tumor was impossible.

Edna M. Reynolds.

16

INJURIES

Gallino, J. A., and Oneto, J. A. **Orbital wound produced by indelible pencil.** Arch. de Oft. de Buenos Aires, 1939, v. 14, Dec., p. 1027.

After a thorough bibliographic review of the subject, the author reports the case of a 27-year-old man who sustained a perforating wound of the upper lid with an ordinary indelible pencil. Marked edema and inflammatory reaction followed the accident, and upon examination 21 days later there was considerable swelling and redness of the skin of the lid resembling the appearance of phlegmon of the orbit. There was a moderate amount of blue-violet discharge from the wound and considerable epiphora with violet-colored tears. Between the insertions of the external and superior recti there was an area of necrotic tissue from which numerous particles of indelible lead were removed. The condition gradually subsided and at the end of 15 days the eye was practically normal.

Indelible-pencil wounds are, as a general rule, of a serious character and have a guarded prognosis. When the orbit, the eye, or its appendages are concerned, immediate treatment must be instituted by surgically removing the fragments of the staining substance as well as all surrounding necrotic tissue. Postoperative irrigations with a 5 to 10-percent solution of tannic acid are useful as they form an insoluble compound with basic anilins, thus preventing diffusion. Sodium chloride, boric acid, and bichloride of mercury are contraindicated.

Plinio Montalván.

Jayme, G. G. **Cephalic tetanus following injury to the eyeball.** Amer. Jour. Ophth., 1941, v. 24, Nov., pp. 1281-1298.

Keschner, M., and Rosen, V. H. **Optic neuritis caused by a coal-tar hair dye.** Arch. of Ophth., 1941, v. 25, June, pp. 1020-1024.

The authors report the case of a woman aged 37 years who presented bilateral intraocular optic neuritis, giving the appearance of papilledema. An erroneous diagnosis of tumor of the brain was made, which was discarded after a history had been obtained of the application of coal-tar hair dye three days prior to the onset of symptoms. It is possible that the attempted removal of the dye from the forehead with ammonia played an auxiliary part in hastening its absorption. Suggestions from the literature concerning the possible mechanisms of toxic absorption of aniline dyes are reviewed.

J. Hewitt Judd.

Law, T. B. **A method of dealing with fractures through the infraorbital margin.** Med. Jour. Australia, 1941, v. 1, May 31, p. 666.

The author describes a technique

which he considers simple and very satisfactory from the standpoint of alignment and prevention of subsequent deformity. Eight cases are reported, with notes on causative factors and the more important anatomic features. F. M. Crage.

Leydhecker, F. K. **Removal of nonmagnetic intraocular foreign bodies.** Graefe's Arch., 1940, v. 141, pt. 6, pp. 665-701.

This is a review of the literature on recent methods of removal of nonmagnetic intraocular foreign bodies, and is not amenable to abstracting.

Frances C. Cogan.

Loewenstein, Arnold. **Argyrosis of conjunctiva, cornea, and tear sac.** Brit. Jour. Ophth., 1941, v. 25, Aug., pp. 360-369.

The author finds that while argyrosis of the conjunctiva is frequent, that of the cornea is rarely mentioned because of its clinical insignificance. Argyrosis of the tear sac would be more frequently observed if the tear sac were examined histologically. A case is presented to illustrate the points under discussion. Histologic examination of the excised argyrotic conjunctiva and tear sac revealed that the epithelium did not store any silver particles either within the conjunctiva or in the tear sac, silver-stained fibers were far more frequent in the sac than in the conjunctiva, storage of silver particles was found both within the elastic fibers and free in the tissue, and the deeper the silver corpuscles were situated the darker they appeared. (Figures, references.) D. F. Harbridge.

Mielke, Sophus. **The role of electrochemical processes in chalcosis of the lens and cornea.** Graefe's Arch., 1940, v. 141, pt. 6, pp. 644-654.

In ocular chalcosis, copper is deposited chiefly in the limbal area of the cornea between the endothelium and Descemet's membrane and in the lens between the epithelium and the anterior lens capsule in the pupillary region. The author believes that the most important factor determining this distribution is the difference in potential existing between the cornea and the posterior pole of the eye. The cornea is normally positive to the posterior pole (Kohlrausch). It is assumed that the positive copper ions are attracted toward the cornea. The anterior lens capsule and Descemet's membrane act as barriers to the ions, with resultant collection of copper behind them.

The following experiment is offered as supportive evidence. A copper wire was attached to the positive pole of a 4.5-volt battery. Its free end was introduced into the vitreous of an enucleated pig's eye and the eye was suspended in physiologic saline solution so that only the cornea was immersed. The negative pole was connected with a carbon rod which was also immersed in the saline solution. This resulted in a difference of potential in the same direction but greater than that normally present. After four hours copper salts were recognizable in the vitreous. In eight hours the regions of the anterior and posterior lens capsules were colored green. In eighteen to twenty-four hours a macroscopic deposit of copper was seen between Descemet's membrane and the corneal endothelium. Frances C. Cogan.

Robertson, C. K. **Sudden blindness following gastro-intestinal hemorrhage.** Edinburgh Med. Jour., 1941, v. 48, June, pp. 414-418.

A case of amaurosis developed as a result of severe hematemesis. This was

due to a hemorrhage from a duodenal ulcer which reduced the red-cell count to 3,400,000, with 45-percent hemoglobin. On the third day following the hemorrhage there was sudden complete loss of vision in each eye at an interval of about 12 hours. Ophthalmoscopic examination showed pallor of the discs, collapsed blood vessels, and retinal anemia. There had been no change after an interval of one year.

T. E. Sanders.

Smith, F. P. E. **Eye injuries in agriculture.** Trans. Ophth. Soc. United Kingdom, 1940, v. 60, p. 252.

The author reports 259 cases of injury to the eyes of persons engaged in agricultural work. Ninety-nine cases were entered as "bush injuries," the eye having been struck by bushes while hedging. Violent accidents caused by cattle were more common among older men. Of the chemicals, lime burns were the most common. Fertilizers not infrequently were the cause of injuries to the cornea. Spectacles are recommended to protect the eyes of farmers. Beulah Cushman.

Steel, Janet. **Macular burning and ring scotoma.** Glasgow Med. Jour., 1941, v. 135, March, p. 73.

The authors discuss the literature relating to the visual and pathologic effects produced by an intense light beam upon the fovea (macular burning), with attention placed upon the accompanying ring scotoma. They theorize as to the cause for the latter. A case is reported. Robert O. Sherwood.

Tidy, H. L. **Loss of vision following hemorrhage.** Brit. Med. Jour., 1941, May 24, p. 774.

The author discusses this condition, the possible mechanism, and the pathologic findings. He reports a case which recovered. Robert O. Sherwood.

17

SYSTEMIC DISEASES AND PARASITES

Andrade, Cesario de. **Chagas's disease; the ocular conjunctiva as the most frequent route of infection.** Arch. of Ophth., 1941, v. 26, Sept., pp. 341-346.

American trypanosomiasis, called Chagas's disease in honor of its discoverer, is a tropical disease frequently encountered in South and Central America, and is caused by a flagellate protozoön which is transmitted to man and animal by blood-sucking insects. The ocular disease is characterized by: (1) sudden onset of palpebral inflammation and conjunctivitis; (2) appearance of painless elastic edema, which gives a characteristic red-violet color to the eyelid; (3) hyperemia and edema of the conjunctiva; (4) progression of edema to nearby regions of the face and body on the same side as the involved eye and sometimes also on the opposite side; (5) lack of clinical signs in the cornea and in the inner structures of the eye; (6) scanty conjunctival secretion; (7) satellite glandular reaction of the preauricular, parotid, or submaxillary glands of the same side; (8) greater enlargement of one of the glands than of the others; and (9) slow regression of inflammation of the involved eye or sometimes persistence of the inflammation. The frequent clinical occurrence of ocular disease in trypanosomiasis seems to indicate that the ocular conjunctiva is the most frequent route to infection, although not the only one. Unilaterality or bilaterality of the ocular disease depends upon whether the trypanosomal inoculation occurs in one eye or simultaneously in

both eyes. The trypanosomal ocular disease is purely a local reaction which marks the onset of the infection either in one eye or simultaneously in the two eyes. (Discussion.) J. Hewitt Judd.

Argañaraz, Raul. **Experimental anaphylaxis and allergy of the eye.** Arch. de Oft. de Buenos Aires, 1939, v. 14, Nov., p. 943.

The author has produced experimentally an allergy of the conjunctiva in a rabbit sensitized to horse serum by conjunctival instillations of the same allergen. In like manner, phlyctenular keratoconjunctivitis was reproduced. The possible application of these experimental findings to allergic manifestations of the human eye is discussed in detail. Plinio Montalván.

Calcagno, Blas. **Ocular disturbances of the menopause treated with artificial estrogens.** La Semana Med., 1941, v. 48, Sept. 11, p. 657.

In the two cases here reported the author administered estrogenic injections for inflammatory and edematous disturbances of the conjunctiva and cornea, in association with general disturbances commonly attributed to the climacteric. W. H. Crisp.

Coppez, H. **Treatment of hysteric accidents with convulsive therapy.** Ophthalmologica, 1941, v. 102, July, p. 1.

The author reports his experience with one patient who was cured of hysterical blindness after injection of pentamethylentetrazol. With a few brief quotations from the work of others, he justifies the belief that the therapeutic effect is to be ascribed to the destruction of a blocking in intracortical association paths. The intense fear and feeling of impending death which accompany the treatment do not explain its effect.

F. Herbert Haessler.

Gallino, J. A., and Oneto, J. A. **Crouzon's disease.** Arch. de Oft. de Buenos Aires, 1939, v. 14, Dec., p. 1010.

A typical case of craniofacial dysostosis (Crouzon's disease) is reported in a 19-year-old girl. The family history was negative. The craniofacial malformation was accompanied by bilateral exophthalmos of 25 mm., divergent strabismus, postneuritic atrophy of the right eye, and marked abnormalities of the teeth and alveoli. The history and bibliography of the disease are fully reviewed and numerous photographs and X rays of the skull are presented. (Bibliography.) Plinio Montalván.

Johnson, L. V. **Chemical ocular conditions associated with vitamin-B-complex deficiency.** Amer. Jour. Ophth., 1941, v. 24, Nov., pp. 1233-1240.

Kamel, Ahmed. **Ophthalmomyiasis.** Giza Mem. Ophth. Lab., 1938, 13th rept., p. 108.

A classification and description of the various types of flies producing infestation of the eye and its adnexa is given in detail and 32 cases of myiasis are reported. (Bibliography.)

Edna M. Reynolds.

Levitt, J. M. **Boeck's sarcoid with ocular localization.** Arch. of Ophth., 1941, v. 26, Sept., pp. 358-388.

The findings of previously reported cases are summarized, and a case of Boeck's sarcoid is reported in which there was involvement of the eyes, skin, lungs, lymph nodes, bones, and brain, with the diagnosis confirmed by biopsy of the skin and of a lymph node. The right eye presented a low-grade

descemetitis, retinal periphlebitis, and choroiditis. The left eye presented a malignant uveitis and secondary glaucoma, which culminated in hypotension and phthisis bulbi. Microscopic study of the excised left eye showed a widespread nodular uveitis and retinitis, with plastic exudation into the aqueous and vitreous chambers. The origin of tubercle-like lesions from retinal blood vessels was strongly suggested. The exudates in the chambers tended also to assume the appearance of tubercles. Evidently they were formed purely from wandering cells. As in other reported lesions of Boeck's sarcoid, no caseation necrosis was present in the epithelioid nodules, but in all other respects the nodules resembled those of tuberculosis. The development of tubercle-like structures along the line of the scar of the iridectomy incision tends to support the conception of this disease as an infectious process. The uveal lesion in Boeck's sarcoid represents a true localization of the disease rather than a coincident infection. The histologic appearance corresponds to changes observed in other involved organs. The study does not clarify the underlying cause of the ocular lesion. The histologic picture, coupled with the clinical picture of bilateral uveitis associated with periphlebitis retinalis and choroiditis of one eye, would ordinarily be considered of tuberculous causation. The association of the lesion with Boeck's sarcoid makes this assumption doubtful. In cases of uveitis that presents clinically the syndrome of uveal tuberculosis, it is necessary to consider Boeck's sarcoid in diagnosis. The ocular lesion may occur as the earliest or even as the sole manifestation of Boeck's sarcoid. If Boeck's sarcoid is proved to be nontuberculous, then the conception of uveitis with similar clinical and pathologic appearances may have to be altered. J. Hewitt Judd.

Quevedo, Arturo. **Ocular onchocerciasis.** Amer. Jour. Ophth., 1941, v. 24, Oct., pp. 1185-1189.

Woods, A. C., and Burky, E. L. **Effects of sensitivity and immunity in experimental lesions of ocular tuberculosis.** Sec. on Ophth., Amer. Med. Assoc., 1940, 91st mtg., pp. 38-49. (See Amer. Jour. Ophth., 1941, v. 24, July, p. 845.)

18

HYGIENE, SOCIOLOGY, EDUCATION, AND HISTORY

Hardesty, J. F. **Blind pensioners in Missouri.** Jour. Missouri State Med. Assoc., 1941, v. 38, July, p. 223.

A statistical survey of blind pensioners in Missouri shows, among other things, that the three most frequent causes of blindness are: cataract, 25 percent; trachoma, 16.5 percent; glaucoma, 14.3 percent.

Theodore M. Shapira.

Lisch, K. **Mistaken views in the field of ophthalmologic racial hygiene.** Klin. M. f. Augenh., 1941, v. 106, March, pp. 257-263.

The German law is not quite clear on the question of whether persons with hereditary diseases causing blindness (such as congenital cataract) should be sterilized even though surgical treatment restores vision in a high percentage of the cases. The author is of the opinion that regardless of possible treatment these cases should be sterilized. Gertrude S. Hausmann.

Métivier, V. M. **Eye disease due to vitamin deficiency in Trinidad.** Amer.

Jour. Ophth., 1941, v. 24, Nov., pp. 1265-1280.

Pfeiffer, R. L., and Booth, A. O. **Blindness in the state of New York.** Arch. of Ophth., 1941, v. 26, July, pp. 85-97.

Statistics on blindness are incomplete and compilation is greatly handicapped by insufficient or inaccurate data. In a two-year period, 2,685 cases of blindness were reported in the state of New York. According to the records of age at onset, 10 percent of the patients were under one year of age. Hereditary and congenital diseases, anomalies and ophthalmia neonatorum were the chief causes. Seventy-five percent of the patients were past forty years of age, and 60 percent were males. Diseases of the optic nerve accounted for 561 (20 percent) cases, and 135 of these were syphilitic. Diseases of the retina produced blindness in 379 (14 percent). Diseases of the cornea led to blindness in 13.5 percent, and 270 of the 363 cases were attributed to leucoma of the cornea. Glaucoma was the fourth most prevalent cause of blindness, there being 336 cases (12.5 percent), and diseases of the lens resulted in blindness in 307 cases (11.4 percent). J. Hewitt Judd.

Pryor, H. B. **Physical and physiologic differences in the eyes related to body build.** Arch. of Pediatrics, 1941, v. 58, July, p. 431.

Presents data to show that certain physical and physiologic differences in the eye appear to be related to general body build.

Theodore M. Shapira.

Robbins, C. E. **Causes of blindness in South Dakota.** Jour. Lancet, 1941, v. 61, June, p. 219.

The article describes in brief the present program for needy blind in South Dakota. Eight tables attempt to give a picture of the blind population in the state. F. M. Crage.

Steggerda, Morris. **Form discrimination test as given to Navajo, Negro, and white school children.** Human Biology, 1941, v. 13, May, p. 239.

For the discrimination test of form, figures consisting of sets of circles and incomplete circles, octagons, and incomplete octagons, and symmetrical triangles and imperfect triangles, were used in groups of Dutch, Jamaica-white, Jamaica-colored, and Navajo Indian, children of both sexes from 9 to 17 years of age. Scores were analyzed as to group results. The author suggests that trachoma may be the cause for the poor showing made by the Navajo children. (Graphs, charts.)

Robert O. Sherwood.

19

ANATOMY, EMBRYOLOGY, AND COMPARATIVE OPHTHALMOLOGY

Crozier, W. J., and Wolf, E. **The simplex flicker threshold contour for the zebra finch.** Jour. Gen. Physiology, 1941, v. 24, May 20, p. 625.

Studies of response to visual flicker were made on the zebra finch. It was found that the retina of this bird is devoid of rods. The authors describe their technique and discuss some points of interpretive visual theory in relation to the present measurements.

F. M. Crage.

Sondermann, R. **Contribution to knowledge of development and significance of the vortex veins.** Graefe's Arch., 1940, v. 141, pt. 6, pp. 598-603.

According to previous studies by

the author, the scleral portions of the vortex veins have a pressure of 50 mm. Hg, which is thought to be necessary for the maintenance of normal intraocular pressure.

The existence of such a high venous pressure is explained on embryologic grounds. The sclera, at first a loose connective tissue, condenses in an anteroposterior direction. The embryologic vortex veins, anchored as they are by their uveal connections, are displaced backward in their scleral portions by the condensing sclera. This accounts for the oblique course of the vortex veins through the sclera in the fully developed eye, a course which permits of considerable constricting pressure on the veins by the sclera. Furthermore the veins, because of their anterior position, are affected by condensation of the sclera sooner than the long posterior ciliary arteries. These factors, combined with the fact that the internal pressure of the veins is normally considerably lower than that of the arteries, make for much more effective constriction of the veins than of the arteries. The result is a congestion of the scleral portion of the vortex veins and an increase of pressure in the uveal veins.

To measure how much pressure the sclera exerts on the vortex veins, the author reduced the intraocular pressure in an eye to zero by removing the vitreous. The subsequent pressure in the vortex veins was found to be between 15 and 20 mm. Hg.

Frances C. Cogan.

PAN-AMERICAN NOTES*

Edited by Dr. M. Uribe Troncoso
500 West End Avenue, New York

Communications should reach the editor by the twelfth of the month

Miscellaneous

New Journal. We have received the third number of the Arquivos Brasileiros de Profilaxia da Cegueira (Oftalmologia Clinica e Social), published under the auspices of the National League for the Prevention of Blindness, Department of Bahia, by Dr. Colombo Spinola and a large editorial staff. The journal appears twice a year, during the months of July and September. Number 3 contains the following articles: "The fight against blindness in Bahia," by Dr. C. Spinola; "Glasses for the conservation of vision in partially seeing children," by Prof. Sylvia M. de Andrade; "Trachoma in Bahia," by Dr. R. Fontes Lima, and "Vision in school children," by Dr. C. Spinola.

Postgraduate Course. Prof. Raul Argañaraz is giving a postgraduate course in ophthalmology, three times a week in the Ophthalmologic Clinic of the Hospital de Clinicas, Buenos Aires, Argentina.

Societies

Second Pan-American Ophthalmologic Congress. At a meeting held by the Uruguayan Society of Ophthalmology on September 12, 1941, Professor Vazquez-Barriere, as vice-president of the Pan-American Congress of Ophthalmology, informed the audience that the city of Montevideo had been chosen as the place for the next Pan-American Congress of Ophthalmology, which will meet in March, 1943.

The Uruguayan Society of Ophthalmology, realizing the outstanding importance of this event and conscious of the great honor paid to Uruguay, has asked for the collaboration of all its members in the organization of the forthcoming Congress.

The following members were elected to comprise the Central Executive Committee: Prof. A. Vazquez-Barriere, president; Drs. C. M. Berro and W. Isola, vice-presidents; Dr. J. A. Sicardi, treasurer; and Drs. A. Paiva, R. Rodriguez-Barrios, and C. Garbino, secretaries.

The Executive Committee has obtained a decree from the Government of the Republic recognizing the official character of the Congress and directing that suitable invitations should be addressed to all the American countries by the Ministry of Foreign Affairs. The Executive Committee chose the month of March for the date of the Congress for then the summer season is at its best; the members of the Congress will be able to enjoy all of the comforts of the large sea-side hotels.

It has also been resolved to add to this Congress a department of Social Ophthalmology which will be recognized as of importance equal to those devoted to science. The purpose of this department will be to coördinate the efforts of all the American countries in the great social work of the prophylaxis of blindness and the struggle against trachoma.

During the Fourth Brazilian Congress of Ophthalmology, which convened at Rio de Janeiro in June, 1941, a meeting of the Board of Directors of the Pan-American Congress of Ophthalmology was held with Dr. Harry S. Gradle of Chicago as chairman. Dr. Gradle flew to Brazil especially to attend the assembly.

The following committees were appointed to carry on the work of the Congress:

(1) An International Committee for the Prevention of Blindness. The appointed board consisted of Francisco Belgeri of Buenos Aires, chairman, with a Board of Directors, made up of Dr. B. Courtis (Buenos Aires), Dr. Natalicio de Farias (Rio de Janeiro), Dr. H. Ferrer (Havana), Dr. E. C. Ellett (Memphis, Tennessee), and a representative of Chile, who has not yet been nominated. Later, members will be appointed from the other Latin-American countries for completing the representation in this Continent.

(2) An International Committee for Trachoma. The fight against trachoma was taken up at the same meeting and the following officials appointed for the committee: president, Prof. Ibo C. Correa Meyer (Porto Alegre, Brasil), and Drs. J. Senâ (Buenos Aires), J. Valdeavelano (Lima, Peru), Phillips Thygeson (New York), Polk Richards (New Mexico, U.S.A.). A special report on the incidence of trachoma in the American Continent, its prophylaxis and treatment, will be presented at the Second Pan-American Congress of Ophthalmology, at Montevideo, in 1943.

(3) A Committee for the Interchange of Ophthalmologic Literature. The great importance of this matter for the advancement of ophthalmology in American countries was stressed and a committee appointed.

* With this issue the Journal initiates a new department, devoted to notes and items of interest pertaining to our Pan-American colleagues, which, it is hoped, will serve to establish a closer collaboration between ophthalmologists of the Western Hemisphere.

Arrangements have just been made with the Brazilian quarterly abstract journal, Ophthalmologia Ibero Americana, whereby the latter becomes the official organ of the Pan-American Congress of Ophthalmology. Ophthalmologia now appears in Portuguese only, but after January 1, 1942, all abstracts will be printed in Spanish and English or in Portuguese and English. Original articles, reports of scientific activities of the Congress, news items, and the like, will be presented in all three languages. It is planned to amplify the journal eventually to an all-embracing scope, similar to that formerly fulfilled by the Zentralblatt. Dr. M. Alvaro of São Paulo, Brazil, is the managing editor. The Committee on Literary Exchange, comprised of all of the ophthalmic editors of the Western Hemisphere under the chairmanship of Dr. Lïjó Pavia of Buenos Aires, Argentina, forms the Editorial Board.

Ophthalmologica Ibero Americana will be sent without charge to all members of the Pan-American Congress of Ophthalmology who shall have paid dues in advance. An annual membership fee of $5.00 will be sufficient to supply the journal to all members and to finance the Second Pan-American Congress of Ophthalmology which is to be held in Montevideo in March, 1943. Every ophthalmologist who is interested in the Pan-American development of our science is urged to send his exact name and address together with the annual membership fee of five dollars ($5.00) to

Dr. Conrad Berens, Secretary-Treasurer, Pan-American Congress of Ophthalmology, 411 First Avenue, New York, New York.

(4) An International Committee for the Interchange of Professors and students between the countries of America. This committee will be under the direction of Dr. Luis Fernandez (Puerto Rico). Forming part of the board are: Prof. C. de Andrade (Bahia, Brazil), R. Argañaraz (Buenos Aires), J. M. Espino (Venezuela), Sanford Gifford (Chicago), R. Silva (Mexico), Alan Woods (Baltimore), John Dunnington (New York), and Carlos Finley (Havana).

Mexican Society of Ophthalmology and Otolaryngology. This Society was founded in 1893. The next meeting will take place on December 2, 1943, when the following program will be presented: "Evolution of the sclerocorneal suture and intracapsular extraction in cataract operation," by Dr. Ernesto S. Olmos; "Insomnia of ocular origin," by Dr. Manuel de Rivas Cherif.

The Fifth Brazilian Congress of Ophthalmology. The Society of Ophthalmology of Brazil has designated the city of Bahia as the place of meeting of its Congress in 1943. A local Committee of Organization has been appointed to make all preliminary arrangements for the meeting and scientific exhibition.

On August 16, 1941, the Ophthalmological Society of Cordoba (Argentine) held a meeting at which papers were read by visiting ophthalmologists as follows: "Some observations on macular serous chorioretinitis" and "Stereoradiography in ophthalmology," by Carlos Weskamp; "Considerations regarding some medicolegal experiences," by Vila Ortiz; and "The stenopeic opening in examination of refraction," by Isaac Cotlier.

Personals

Dr. Moacyr E. Alvaro, São Paulo, Brazil, addressed the Reading, Pennsylvania, Society of Ophthalmology and Otolaryngology, October 30, 1941, on "Pan-American ophthalmology."

NEWS ITEMS

Edited by Dr. Ralph H. Miller
803 Carew Tower, Cincinnati

News items should reach the editor by the twelfth of the month.

Deaths

Dr. Lester Edgar Schoch, Elysburg, Pennsylvania, died September 7, 1941, aged 77 years.

Dr. James Black Merritt, III, Easton, Maryland, died September 3, 1941, aged 58 years.

Dr. Aaron Samuel Green, San Francisco, California, died September 9, 1941, aged 62 years.

Dr. Ernest Page Fuller, Lawrence, Massachusetts, died September 14, 1941, aged 68 years.

Dr. George R. Sledge, Parksley, Virginia, died October 3, 1941, aged 61 years.

Dr. Charles E. Burnham, Bay Springs, Mississippi, died October 1, 1941, aged 70 years.

Dr. Patrick F. Kelleher, Cambridge, Massachusetts, died September 24, 1941.

Dr. Edward G. Trowbridge, Chicago, Illinois, died September 29, 1941, aged 86 years.

Dr. Emily H. Selby, Chicago, Illinois, died September 9, 1941, aged 80 years.

Dr. Carl Smith, Philadelphia, Pennsylvania, died July 30, 1941, aged 68 years.

Dr. William M. Mehl, Buffalo, New York, died November 28, 1941, aged 64 years.

Dr. Wesley Franklin Kunkle, Williamsport, Pennsylvania, died October 26, 1941, aged 77 years.

Dr. William T. Morrissey, New Britain, Connecticut, died October 23, 1941, aged 59 years.

Dr. William Sheffield Norton, Muscatine, Iowa, died September 3, 1941, aged 74 years.

Miscellaneous

According to a study sponsored by the National Society for the Prevention of Blindness and issued by the Columbia University Press, 98 percent of American industrial ocular injuries, which occur at a rate of 1,000 a day, represent an annual loss of $200,000,000 and are wholly unnecessary. Since industrial efficiency is so vitally important at the present time in national defense, elimination of eye hazards in industry must be accomplished. This study reveals the means of averting the financial loss and human suffering resulting from the blinding of industrial workers and urges the coöperation of employers and employees.

The National Society for the Prevention of Blindness, Inc., held its biennial conference December 4 to 6 at the Hotel Astor, New York City. The conference covered the following subjects: Mobilization of state forces for prevention of blindness; Prevention of blindness from glaucoma; Causes of blindness; Restoration of sight; Eyes in national defense; and Care of partially seeing children. Among the participants in these discussions were: Drs. Ellice M. Alger, New York City; Mark J. Schoenberg, New York City; Garrett L. Sullivan, Boston; Edward C. Ellett, Memphis; Frank G. Boudreau, New York City; C. C. Pierce, New York City; William Allan, Winston-Salem, North Carolina; Leona Baumgartner, New York City; Harry S. Gradle, Chicago; Leonard Greenburg, New York City; Herman E. Hilleboe, Saint Paul, Minnesota; Frank J. O'Brien, New York City; and Iago Galdston, New York City.

The George Washington University School of Medicine will present an intensive postgraduate course in aviation ophthalmology and aviation medicine, February 5th to 7th. This three-day course embraces all the important phases of aviation medicine and is urged for training doctors in becoming flight surgeons.

The regular postgraduate course in ophthalmology is being given February 2d to 4th, inclusive.

The American Orthoptic Council will conduct two examinations for orthoptic technicians in 1942. The first examination will be held in New York, preceding the meeting of the American Medical Association in June. The second examination will be held in San Francisco just preceding the meeting of the American Academy of Ophthalmology and Otolaryngology in October. One written examination will be conducted throughout the country in May, one month prior to the first examination. Applications to take this examination must be received by Dr. Le Grand H. Hardy, 23 East 79th Street, New York, before April 1st. Only those passing the written examinations will be eligible to take either of the practical and oral examinations.

The British Journal of Ophthalmology reports an increased subscription rate due to advance in prices of paper and similar commodities. The British Journal is maintaining its standards in spite of war conditions and attending hardships.

Postgraduate courses in ophthalmology were

given by the University of Glasgow from September 10 to October 29, 1941, and at Oxford from October 13th to December 5th.

The Division of Child Hygiene of the Massachusetts Department of Health has adopted the Massachusetts Vision Test as the official test for visual acuity to detect children needing the attention of an eye specialist.

Societies

At the November dinner meeting of the Cleveland Ophthalmological Club, the guest speaker was Dr. Virgil Casten of Boston, who spoke on "Vertical motor anomalies." Dr. Casten's paper was illustrated with lantern slides.

Dr. Paul Boeder of Southbridge, Connecticut, recently addressed the Cleveland Ophthalmological Club on "Aniseikonia—its interpretation."

At the meeting of the Eye Section of the Philadelphia County Medical Society held November 6, 1941, the topic of Dr. Sidney L. Olsho's address was "Concerning bifocals in aphakia." Case reports were presented by Drs. Alan S. Crandall and Irving H. Leopold of the University of Pennsylvania Hospital, and a pathology report was given by Dr. Harold M. U'Ren, Wills Hospital.

The Fourth Annual de Schweinitz lecture was delivered before the Section on Ophthalmology of the College of Physicians of Philadelphia on November 19th by Dr. Harry Friedenwald, professor emeritus of ophthalmology, University of Maryland School of Medicine, Baltimore. The title of the lecture was "The paths of progress of ophthalmology."

The North of England Ophthalmological Society convened at Leeds, December 6, 1941; the meeting at Newcastle-on-Tyne will be held on February 7, 1942; at Liverpool on March 7, 1942; and at Sheffield on April 11, 1942.

The Ophthalmological Society of the United Kingdom convened at Cambridge on September 4 and 5, 1941. The subject discussed was "Ocular injuries resulting from the war."

The fourteenth annual spring clinical conference of the Dallas Southern Clinical Society will be held from March 23 to 26, 1942. Among the honor guests will be Dr. Grady E. Clay, associate professor and chairman of the Department of Ophthalmology, Emory University, School of Medicine, Atlanta, Georgia.

The Reading Eye, Ear, Nose, and Throat Society was recently organized and the following officers were elected: Dr. James E. Landis, president; and Dr. Paul C. Craig, secretary. Membership will be extended by invitation to eligible physicians who hold active membership in the Berks County Medical Society and the Medical Society of the State of Pennsylvania.

Personals

At the luncheon given by the Journal for its collaborators during the meeting of the American Academy of Ophthalmology and Otolaryngology in Chicago, last October, Dr. F. E. Woodruff of Saint Louis was presented with a silver bowl as a token of appreciation of his many years of faithful service in the interests of the Journal. The presentation was made by Dr. Lawrence T. Post.

Dr. Leo L. Mayer announces the opening of offices at 2007 Wilshire Boulevard, Los Angeles, and at 415 North Camden Drive, Beverly Hills. Dr. Mayer was formerly attending ophthalmologist, Michael Reese Hospital, and associate in ophthalmology, Northwestern University Medical School, Chicago.

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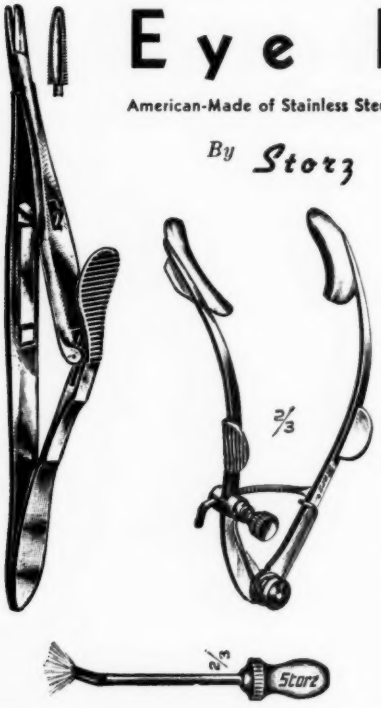

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